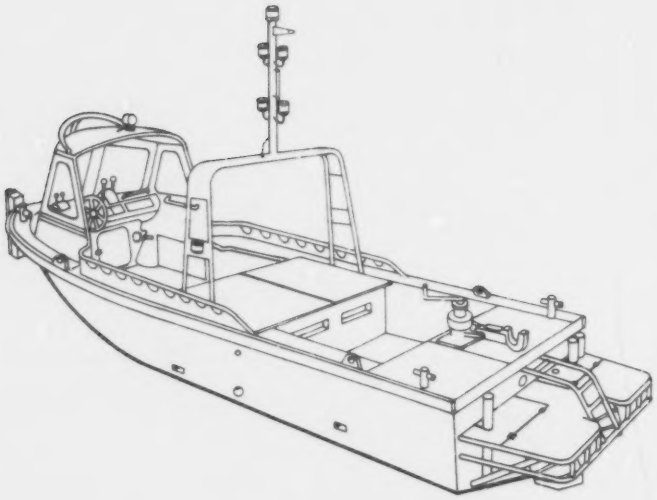
5-1940-277-10

TM 5-1940-277-10

OPERATOR'S MANUAL



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This copy is a reprint which includes current pages from Changes 1 through 6.

BOAT, BRIDGE ERECTION, TWIN JET, ALUMINUM HULL

MODEL USCSBMK I

(1940-01-105-5728)

HEADQUARTERS, DEPARTMENT OF THE ARMY

16 DECEMBER 1981

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TM 5-1940-277-10
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C 6

CHANGE
No. 6

HEADQUARTERS, DEPARTMENT OF THE ARMY
AND HEADQUARTERS, U.S. MARINE CORPS
WASHINGTON, D.C., 24 June 1988

Operator's Manual

BOAT, BRIDGE ERECTION,
TWIN JET, ALUMINUM HULL,
MODELS USCSBMK1 (1940-01-105-5728)
AND
USCSBMK2 (1940-01-218-2165)

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2-33 and 2-34	2-33 and 2-34
2-43 and 2-44	2-43 and 2-44
B-5/B-6	B-5/B-6

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By Order of the Secretaries of the Army and Navy (Including the Marine Corps).

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Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

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Executive Director
Marine Corps Research
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C 5

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No. 5

HEADQUARTERS, DEPARTMENTS OF THE
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Operator's Manual

BOAT, BRIDGE ERECTION, TWIN JET, ALUMINUM HULL,
MODELS USCSBMK1 (1940-01-105-5728) AND USCSBMK2 (1940-01-218-2165)

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CHANGE
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Operator's Manual

BOAT, BRIDGE ERECTION,
TWIN JET, ALUMINUM HULL,
MODEL USCSMBK1 AND USCSBMK2

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-----	1-6.1 and 1-6.2
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Operator' Manual

BOAT, BRIDGE ERECTION,
TWIN JET, ALUMINUM HULL
MODEL USCSBMK 1
(1940-01-105-5728)

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TM 5-1940-277-10
C 2

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NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 5 October 1984

OPERATOR'S MANUAL

BOAT, BRIDGE ERECTION, TWIN JET,
ALUMINUM HULL MODEL USCSBMK 1 (1940-01-105-5728)

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I-1 thru I-5/I-6	I-1 thru I-5/I-6

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CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 23 May 1983

Operator's Manual

BOAT, BRIDGE ERECTION,
TWIN JET, ALUMINUM HULL
MODEL USCSBMK 1
(1940-01-105-5728)

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Major General, United States Army
The Adjutant General

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WARNING

SERIOUS INJURY OR DEATH
may result if personnel fail to observe the following safety precautions:

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

Engine hatch covers must be closed to allow fire extinguisher to extinguish fire.

Batteries give off explosive hydrogen gas. Do not smoke around batteries.

Do not operate engines in an enclosed area without adequate ventilation as carbon monoxide, an invisible poisonous gas, is generated. Symptoms of exposure to carbon monoxide are headache, dizziness, drowsiness, loss of muscular control and coma. Severe exposure can cause permanent brain damage.

Wear life preservers (work vest) at all times when aboard the boat.

Do not allow personnel between boats during slave starting.

Diesel fuel is flammable. Do not allow smoking or any open flames near the boat when you're refueling. Wipe up spilled fuel.

Engines must be shut down during fueling operations. Fire or explosion may result.

Do not turn panel lights on during blackout condition as a lit panel could make you an easy target.

For Artificial Respiration, refer to FM 21-11.

Ear protection (ear plugs) must be worn when operating this boat.

Minimize boat maneuvering against bay until all roadway connectors are in place. Personnel injury could result.

When working near mast assembly, avoid striking head on protruding parts of mast assembly. To avoid injury be aware of mast assembly position when working below mast.

The boat is only to be used for towing when the quick-disconnect towing hook is installed and operational.

TECHNICAL MANUAL

HEADQUARTERS DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. MARINE CORPS
WASHINGTON, D.C., 16 December 1981

Operator's Manual

BOAT, BRIDGE ERECTION, TWIN JET, ALUMINUM HULL, MODELS USCSBMK1 (1940-01-105-5728) AND USCSBMK2 (1940-01-218-2165)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, Headquarters, U.S. Army Troop Suppport Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Blvd., St. Louis MO 63120-1798. A reply will be furnished directly to you.

Marine Corps users shall submit NAVMC Form 10722, Recommended Changes to Technical Publications. Send to: Commanding General, Marine Corp Logistics Base (Code 850), Albany, GA, 31704-5000.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

a. Type of Manual: Operator's Manual.

b. Model Number and Equipment Name: Bridge Erection Boat, Twin Jet, Aluminum Hull. The model numbers assigned to this equipment are USCSBMK1 and USCSBMK2.

c. Purpose of Equipment: Support bridging an amphibious operations. May also be used as general purpose workboat in support of diving operations and maritime projects, for inland water patrols, and as a safety boat for amphibious river crossings.

WARNING

The boat is only to be used for towing when the quick-disconnect towing hook is installed and operational.

d. Special Limitations on Equipment: When used to ferry troops or cargo, the safe carrying capacity is limited to a maximum of 12 fully equipped troops, plus three crew members or 4400 pounds (2000 kilograms) plus three crew members. When the boat is used for towing, the towing capacity is 4,000 pounds (2000 kilograms), plus three crew members.

e. Special Inclusions in Manual: This manual contains instructions for bridging and rafting.

1-2. MAINTENANCE FORMS AND RECORDS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps personnel will prepare and maintain records and report forms as prescribed by TM 4700-15/1, Equipment Record Procedures.

1-3. HAND RECEIPT (-HR) MANUALS. This manual has a companion document with a TM number followed by "-HR" (which stands for Hand Receipt). The TM 5-1940-277-10-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEIL, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 310-2:

U.S. Army Adjutant General Publications Center
2800 Eastern Blvd.
Baltimore, MD 21220-2896

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS. If your boat needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at Commander, Headquarters, Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. U.S. Marine Corps users are encouraged to submit EIRs in accordance with MCO 1650.17. or submit Quality Deficiency Reports in accordance with MCO 4855.10. Mail it to us at Commanding General (P840), Marine Corps Logistics Base, Albany, GA 31704-5000. We'll send you a reply.

1-5. WARRANTY INFORMATION. The Bridge Erection Boat, USCSBMK1, is warranted by Fairey Allday Marine Limited for 12 months. The Bridge Erection Boat USCSBMK2 is warranted by American Development Corporation for 12 months. The warranty starts on the date found in block 23 of DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your organizational maintenance supervisor.

1-6. GLOSSARY

Berth	Place at dock where boat is tied up or anchored.
Capstan	Manually rotated vertical cylinder for winding rope or cable.
Hydrojet	Propelling system that uses water.
MK1 (USCSBMK1)	Combat Support Boat, Mark 1. Original model of Bridge Erection Boat.
MK2 (USCSBMK2)	Combat Support Boat, Mark 2. Modified model of Bridge Erection Boat.
Raw water	River water.
Rub rail	Rubber bumper strip around boat hull.
Scoop	Movable metal cover that directs water stream that comes from hydrojets.
Thermostarter	Glow plug used to preheat intake air for cold starting.
Vdc	Volts direct current.

Section II. EQUIPMENT DESCRIPTION

1-7. PURPOSE OF BRIDGE ERECTION BOAT. A transportable, hydrojet propelled, aluminum hull boat designed to maneuver components of floating bridges. The boat can also be used to propel rafts, support diving operations, assist in maritime construction projects, serve as a troop and cargo carrier, and patrol inland waters.

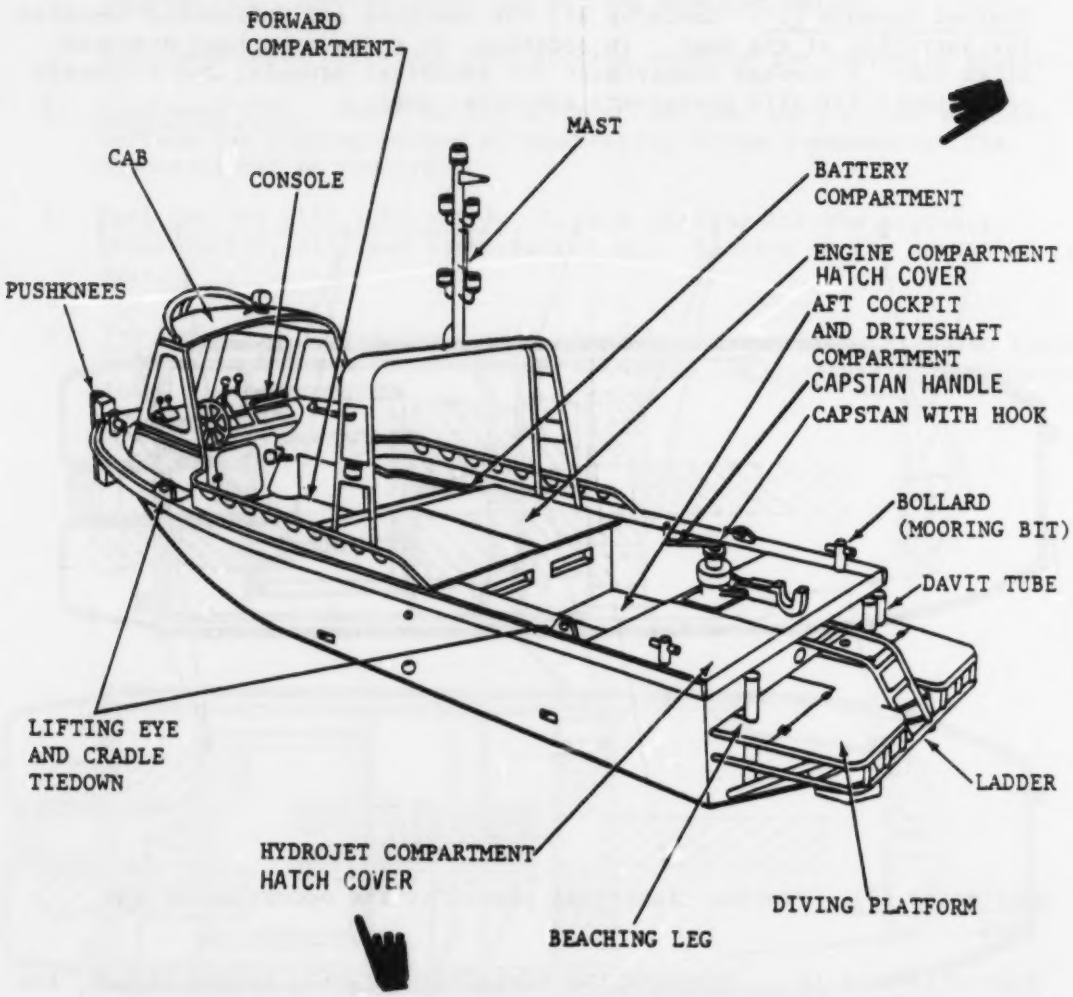
1-8. CAPABILITIES AND FEATURES

a. Can rotate on its own axis at low engine speeds.

b. All weather operational.

c. Transportable by rail, road, sea, and air. (See TB 55-46-1).

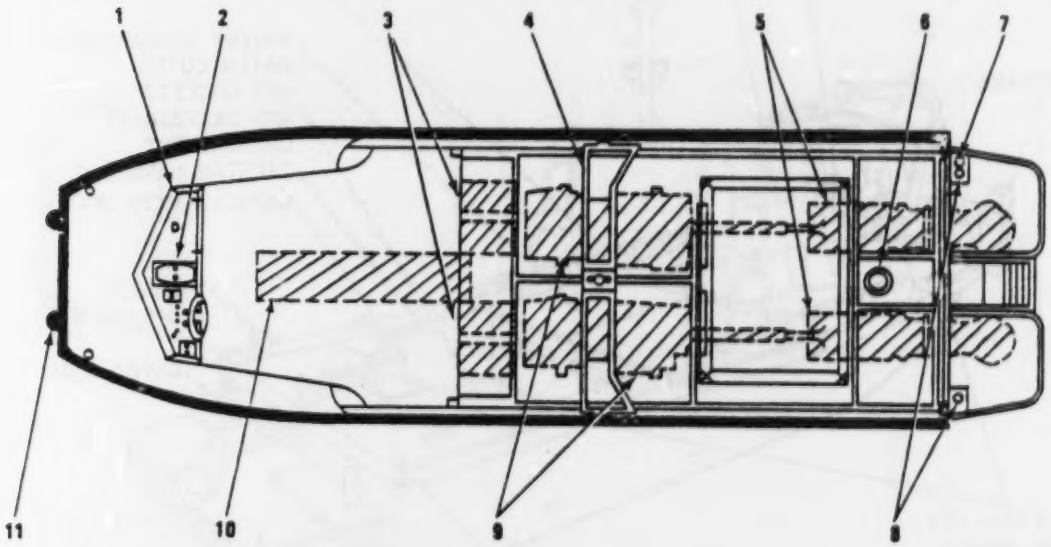
d. Positive Flotation.


FORWARD COMPARTMENT
MAST
CAB
CONSOLE
BATTERY COMPARTMENT
ENGINE COMPARTMENT HATCH COVER
PUSHKNEES
AFT COCKPIT AND DRIVESHAFT COMPARTMENT
CAPSTAN HANDLE
CAPSTAN WITH HOOK
BOLLARD (MOORING BIT)
DAVIT TUBE
LIFTING EYE AND CRADLE TIEDOWN
LADDER
HYDROJET COMPARTMENT HATCH COVER
DIVING PLATFORM
BEACHING LEG

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

a. Removable Cab (1). An aluminum frame with windows and aluminum roof that can be attached to the boat to provide protection for the crew during bad weather. The cab is provided with windshield wipers and a place for attaching searchlight.

b. Control Console (2). Contains all the controls and indicators required for operation of the boat. In addition, it contains a hand operated bilge pump, a stowage compartment for technical manuals, and a stowage compartment for life preservers and other gear.



c. Batteries (3). Provide electrical power for the operation of the boat.

d. Removable Mast (4). Contains the navigation lights, towing lights, and anchor lights. May be lowered to rest on capstan or removed from the boat when lights are not required.

e. Hydrojets (5). Consist of diesel engine driven hydrojet propulsion units with directional nozzles and scoops. The propulsion units propel the boat and steer it.

f. Capstan and Towing Hook (6). Provides the boat with a safe towing capability of 4000 pounds. The hook is of the quick-release lanyard-operated type.

g. Davit Tube (7) (MK1 only). Allows the attachment of a davit (small crane) to the boat for use in diving operations. Not used in U.S. Army operations.

h. Beaching Legs (8). Support the boat in an upright position when on a hard surface and not in cradle. The beaching legs are retractable.

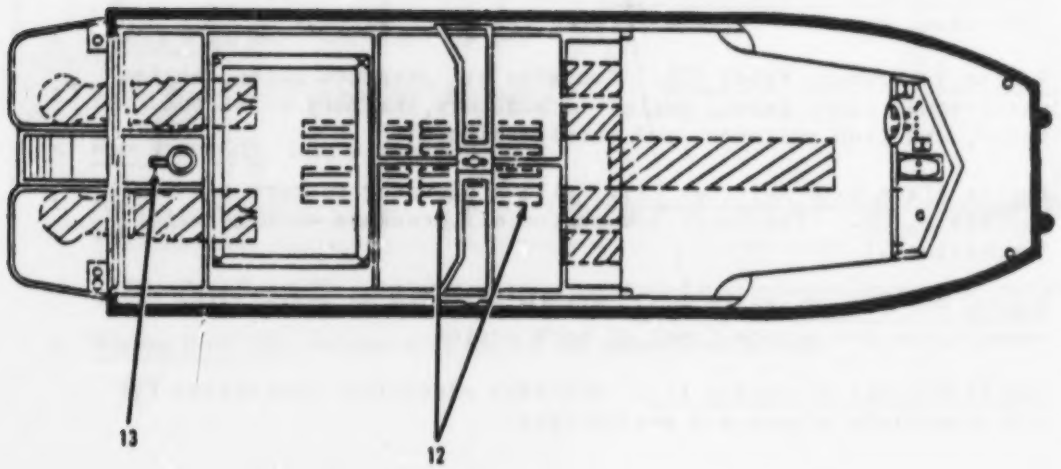
i. Engines (9). Provide power for driving hydrojet units.

j. Fuel Tank (10). Provides fuel storage capacity for operation of boat.

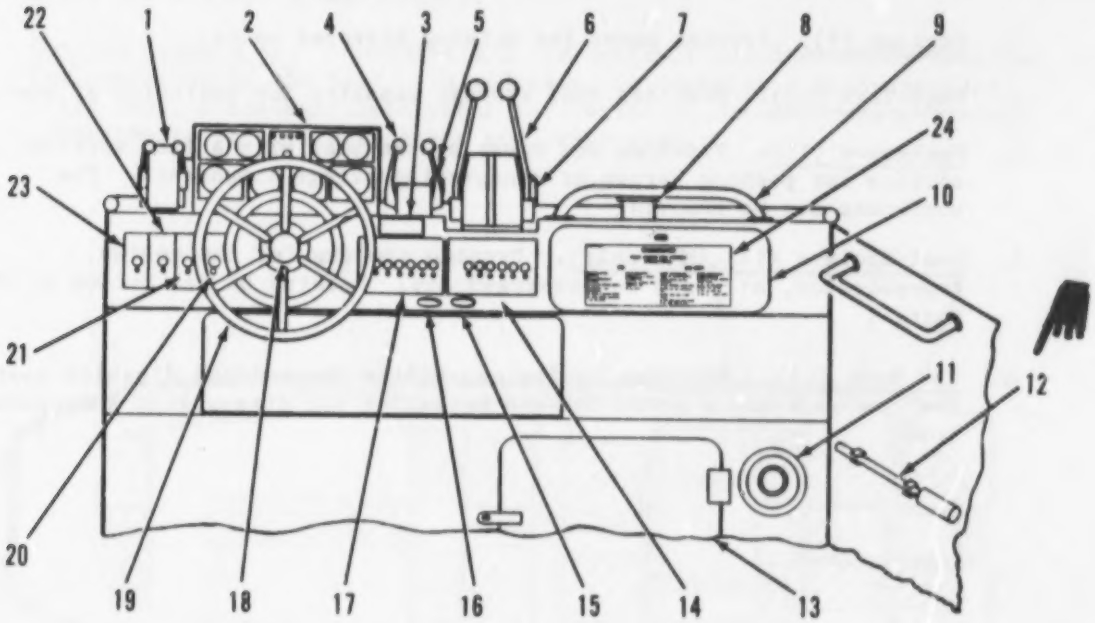
k. Pushknees (11). Provides the front of the boat with a flat vertical surface for pushing barges or maneuvering bridge components. The pushknees can be removed.

l. Keel Coolers (12) (MK2 only). Provide cooling for the engine, transmission, oil, and turbocharged air. Located on the bottom of the boat.

m. Tow Hook (13). Provides towing capability for pulling disabled boats. The tow hook has a quick-release mechanism for disengaging a dangerous load.



1-10. LOCATION AND DESCRIPTION OF FORWARD COCKPIT AND CONTROL CONSOLE. The console is located at the forward end of the boat and contains the controls necessary to operate the boat, the manual bilge pump, and stowage compartments.



a. Transmission Selector Lever (1). Allows operator to place individual gears in forward-neutral-reverse position.

b. Engine Instrument Panel (2). Contains oil pressure gages, engine water temperature gages, engine tachometers, battery condition meter, ignition switches, and warning lights.

c. Engine Alarm Mute Switches (3). Allows operator to turn off engine audible alarm. (Indicates low engine oil pressure or high water temperature.)

d. Engine Throttle Controls (4). Allows operator to control the revolutions per minute (rpm) of each engine.

e. Cab Electrical Connector (5). Provides electrical connection for cab windshield wipers and searchlight.

f. Scoop Control (6). Allows operator to control direction of output from hydrojets to obtain forward and reverse direction of boat. May also be used to assist in turning boat and controlling speed.

g. Searchlight Socket (7). Provides electrical connection for searchlight when cab is removed.

h. Searchlight Mounting (8). Provides mounting for searchlight when cab is removed.

i. Handrail (9). Provides a safety rail.

j. Map Locker (10). Provides a stowage space for technical manuals, charts and maps.

k. Bilge Pump, Hand Operated (11). Provides manual means of pumping water from bilge.

l. Pump Handle (12). Removable handle for hand operated bilge pump. (stowed on starboard bulkhead under the console).

m. Storage Locker (13). Provides a lockable stowage compartment for life jackets and other equipment.

n. Auxiliary Switch Panel No. 1 (14). Contains the electrical switches for wipers, emergency battery link, and searchlight.

o. Engine Stop Control, Starboard (15). Stops the starboard engine when pulled out.

p. Engine Stop Control, Port (16). Stops the port engine when pulled out.

q. Auxiliary Switch Panel No. 2 (17). Contains electrical switches for cabin lights, inspection light, and mast lights.

r. Scoop Position Indicator (18). Provides a means for the operator to position the scoops for straight ahead movement of the boat. (Located on steering column directly behind steering wheel.)

s. Steering Wheel (19). Used to steer the boat.

t. Engine Room Blower Switch (20). Not used.

u. Horn Switch (21). Used to sound horn.

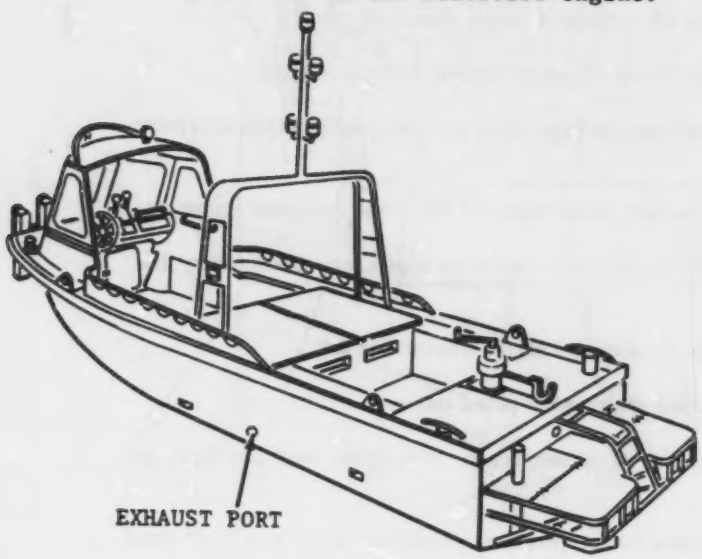
v. Forward Bilge Pump Switch (22). Used to turn the bilge pump located in the engine compartment ON and OFF.

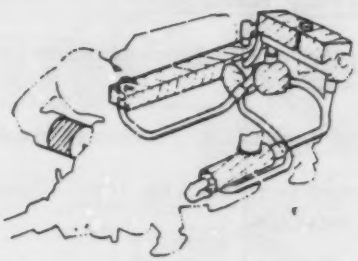
w. Aft Bilge Pump Switch (23). Used to turn the bilge pump located in the hydrojet compartment ON and OFF.

x. Warning Decal (24). Indicates to the operator that caution should be taken.

1-10.1 DIFFERENCES BETWEEN MODELS. There are two models of the Bridge Erection Boat, the MK1 and the MK2. The two models have different engine cooling systems. The MK2 also has several additional features not on the MK1.

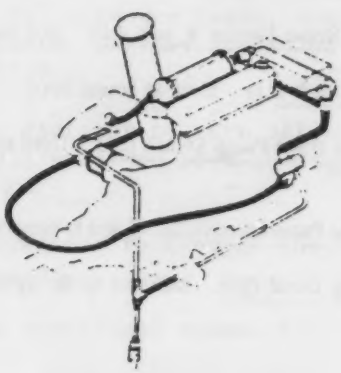
a. MK1. The MK1 uses two cooling systems, one closed system using fresh water and one open system using raw water, to cool each engine. Raw water from the raw water cooling system cools the exhaust system. The exhaust system expels exhaust gas and raw water through ports located to port of the port engine and to starboard of the starboard engine.





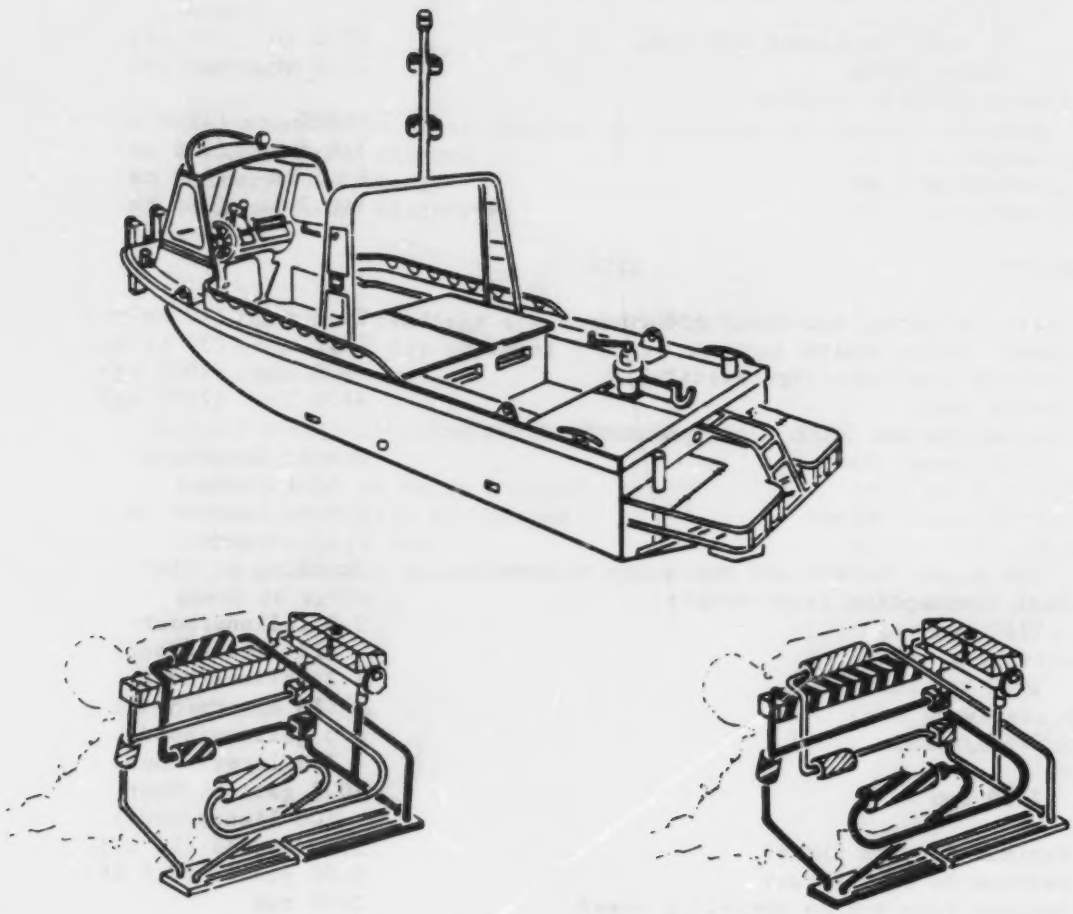
CLOSED COOLING SYSTEM
(FRESH WATER)

WET EXHAUST SYSTEM



OPEN COOLING SYSTEM
(RAW WATER)

b. MK2. Each MK2 engine uses two closed cooling systems which share a common reservoir. The MK2 uses a wet exhaust system similar to the MK1. The hydrojet forces raw water into the exhaust system and out the exhaust port on the side of the boat.



CLOSED COOLING SYSTEMS

(FRESH WATER)

EQUIPMENT DATA

WEIGHTS AND DIMENSIONS

Operating	
Weight, w/ crew, equipment and fuel	8800 lbs (4000 kg)
Length	322.8 in (820 cm)
Beam	98.0 in (249 cm)
Height	
w/o cab or mast	77.9 in (198 cm)
w/ cab	109.8 in (279 cm)
w/ cab and mast	177.9 in (452 cm)
Draft	
w/ crew, equipment and fuel	22.0 in (56 cm)
fully loaded	26.0 in (66 cm)
Transported, w/ cradle	
Weight	10800 lbs (4909 kg)
Length	326.4 in (826 cm)
Height w/o cab	96.3 in (244 cm)
Width	116.3 in (294 cm)

PERFORMANCE

Speed, w/ crew, equipment and fuel	21.6 mph (40 km/hr)
Speed, fully loaded	16.2 mph (30 km/hr)
Maximum load carrying capacity	4400 lbs (2000 kg)
Towing hook	4400 lbs (2000 kg)
Turning radius (with scoops at maximum thrust)	
Full speed ahead	2 boat lengths in 15 seconds
Full speed astern	2 boat lengths in 25 seconds
One scoop forward and one scoop in reverse	Standing circle
Fuel consumption (approximate)	
1750 rpm	2.8 gallons/hour (11 liters/hour)
2000 rpm	4.2 gallons/hour (16 liters/hour)
2250 rpm	6.0 gallons/hour (23 liters/hour)
2450 rpm	10.8 gallons/hour (40 liters/hour)
Maximum forward thrust	3600 pounds (16 kN)
Maximum reverse thrust	2200 pounds (9.8 kN)
Maximum safe engine operating speed (No load governing setting)	2800 rpm

CAPACITY

Fuel	75 gallons (280 liters)

ENGINE INSTRUMENT PANEL GAGE READINGS

Tachometer	
Idle speed	650 to 750 rpm
Operating speed	1000 to 2000 rpm
Maximum speed (under load)	2500 rpm
Engine oil pressure gage	
Idle speed	20 to 30 lb/in^2 (1.4 to 2.1 Kp/cm^2)
Operating speed	40 lb/in^2 or above (2.8 Kp/cm^2)
Coolant temperature gage (fresh water system)	
Normal	Below 195°F (90°C)
Overheating	Above 195°F (90°C)
Battery condition meter (engine not running, no electrical load)	
Battery fully charged	25.4 volts or above
Battery half charged	24.6 to 25.4 volts
Battery fully discharged	23.7 volts or below

NOTE

The above readings are most reliable if the batteries have stood for at least 8 hours without charge or discharge.

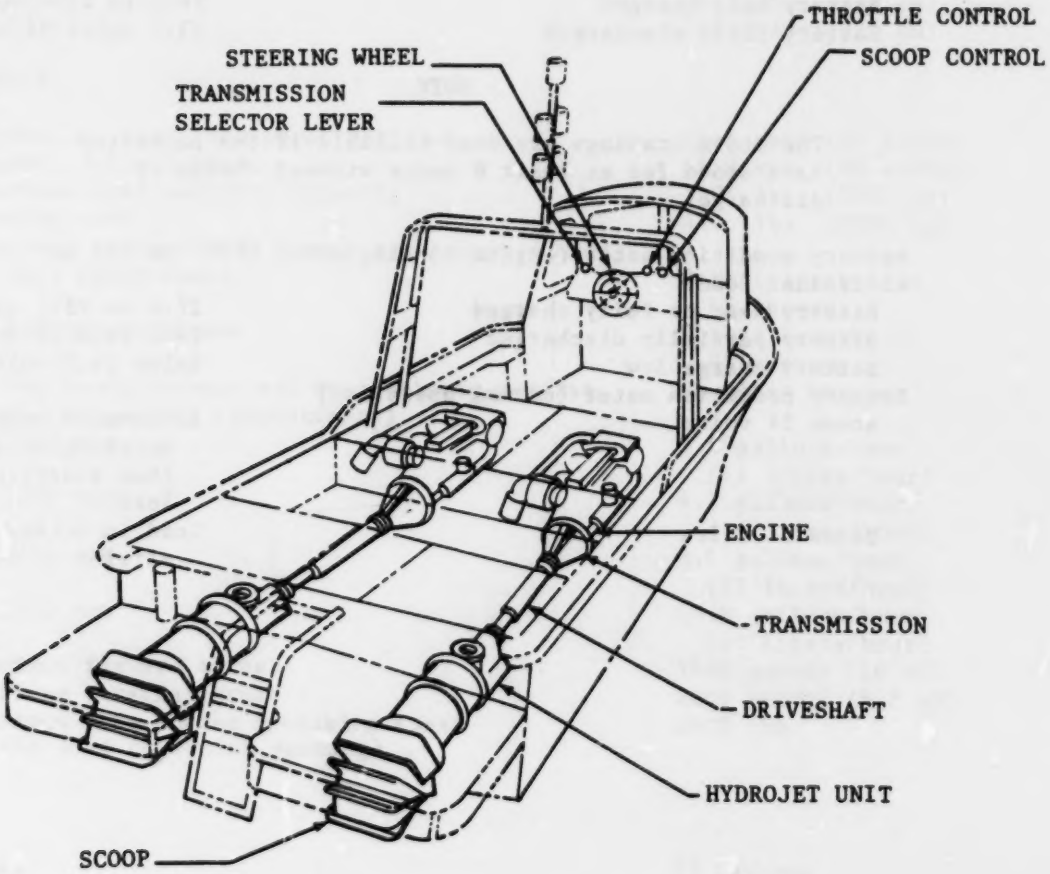
Battery condition meter (engine running about 1500 rpm and no electrical load)	
Battery near to fully charged	27.0 to 28.0 volts
Battery partially discharged	24.0 to 27.0 volts
Battery charge low	Below 24.0 volts
Battery condition meter (normal operation)	
Above 24 volts	Alternator output matching or greater than electrical load
Below 24 volts	Load in excess of alternator output

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-11. PROPULSION SYSTEM

a. Engines - are 363 cubic inches (5.95 liter), 212 horsepower, 6-cylinder, water-cooled, diesel engines. The MK1 engines are provided with both a fresh water (closed) cooling system and a raw water (open) cooling system. The MK2 engines are provided with two fresh water (closed) cooling systems. Engine speed is adjusted by the throttle control mounted on the control console. Fuel is provided by an external fuel system.

b. Transmissions - are 3-position, direct drive, hydraulically operated, oil-cooled units that transmit power from each engine to its respective drive shaft.

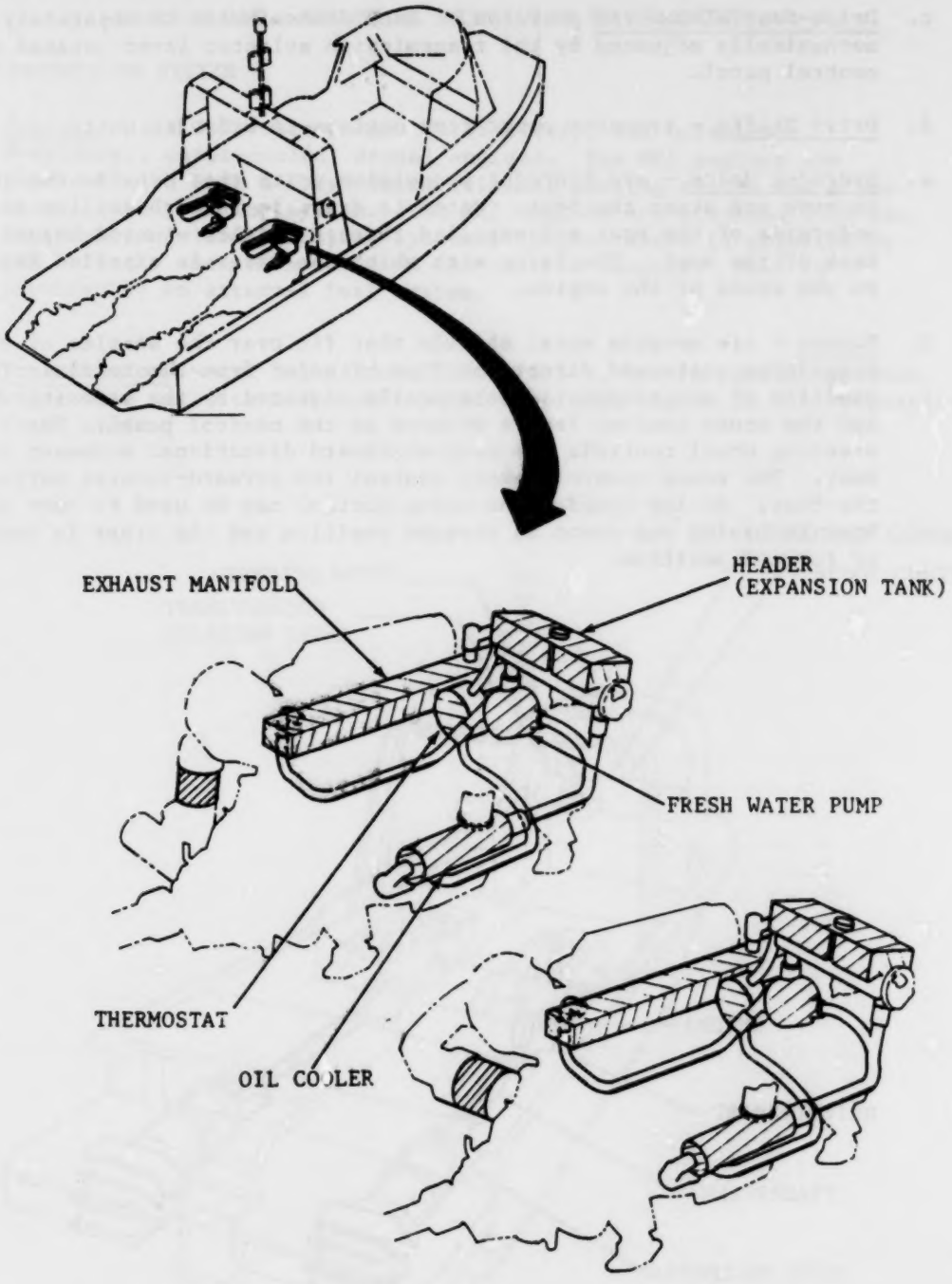


c. Drive-Neutral-Reverse position of each transmission is separately and mechanically adjusted by the transmission selector lever located on the control panel.

d. Drive Shafts - transfer power from engines to hydrojet units.

e. Hydrojet Units - are hydrojet propulsion units that provide the thrust to move and steer the boat. Water is drawn in through grilles in the underside of the boat and expelled through nozzles mounted beyond the back of the boat. The force with which the water is expelled depends on the speed of the engine.

f. Scoops - are movable metal shields that fit over the nozzles of the propulsion units and direct the flow of water from the nozzle. The position of the scoops is mechanically adjusted by the steering wheel and the scoop control levers mounted on the control panel. The steering wheel controls the port-starboard directional movement of the boat. The scoop control levers control the forward-reverse motion of the boat. At low speeds, the scoop control can be used to turn the boat by having one scoop in reverse position and the other in neutral or forward position.



MK1 FRESH WATER ENGINE COOLING SYSTEM

1-12. MK1 ENGINE COOLING SYSTEM

a. Fresh Water Engine Cooling System. The fresh water engine cooling system is identical for both port and starboard engines. Coolant flows from the fresh water pump through the cylinder head and engine block to the exhaust manifold, through the exhaust manifold to the thermostat where it is diverted to the header or to the oil cooler. The coolant flows from the header to the oil cooler and back to the fresh water pump.

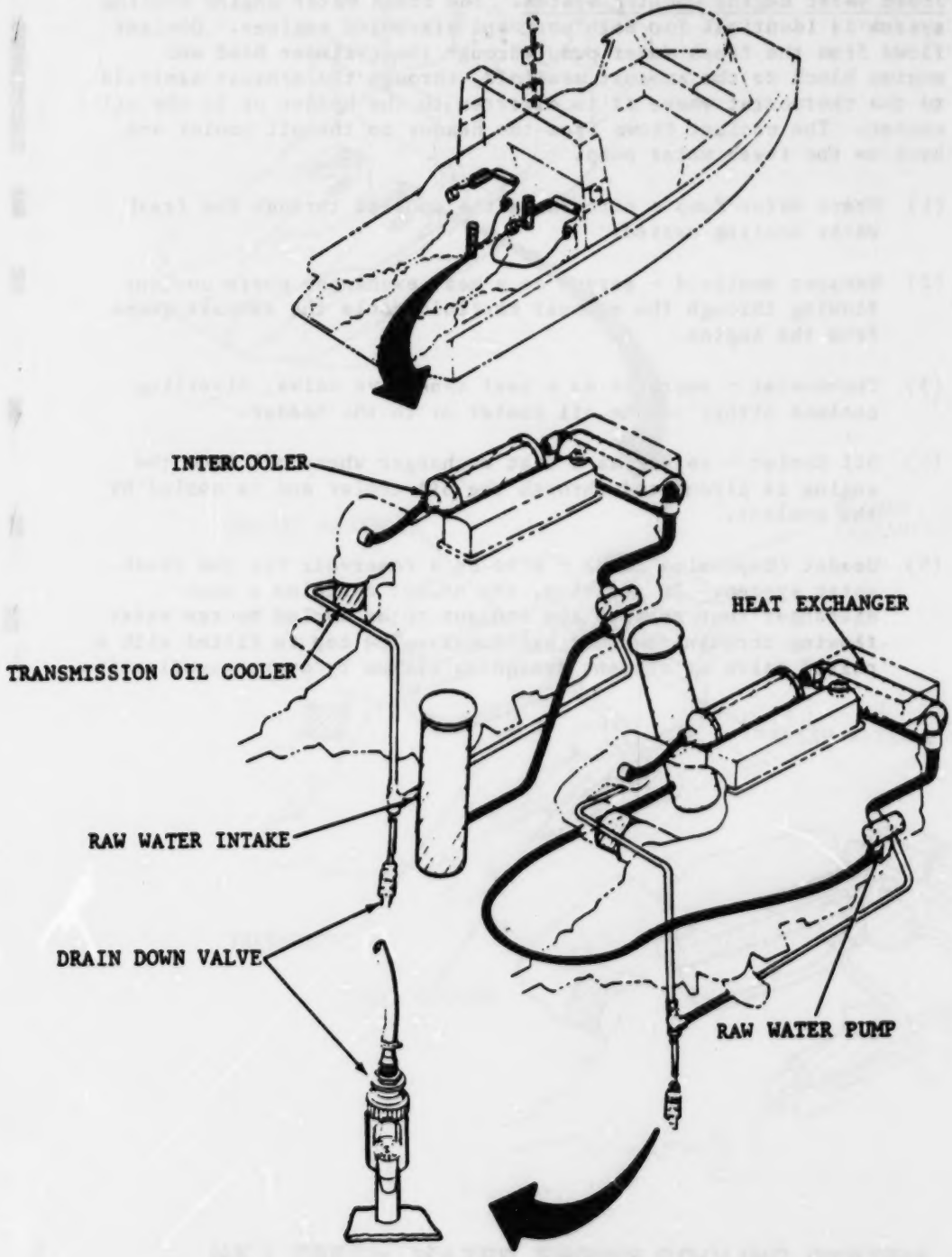
(1) Fresh Water Pump - circulates the coolant through the fresh water cooling system.

(2) Exhaust Manifold - serves as a heat exchanger where coolant flowing through the exhaust manifold cools the exhaust gases from the engine.

(3) Thermostat - operates as a heat sensitive valve, diverting coolant either to the oil cooler or to the header.

(4) Oil Cooler - serves as a heat exchanger where oil from the engine is circulated through the oil cooler and is cooled by the coolant.

(5) Header (Expansion Tank) - acts as a reservoir for the fresh water system. In addition, the header contains a heat exchanger that permits the coolant to be cooled by raw water flowing through the heat exchanger. The cap is fitted with a relief valve to prevent damage to system by overpressurization.



MK1 RAW WATER ENGINE COOLING SYSTEM

b. Raw Water Engine Cooling System. The port engine and the starboard engine have individual raw water cooling systems. Water is drawn from intakes in the bottom of the hull. A raw water pump integral with each engine pumps the water through the transmission cooler, the intercooler, and the heat exchanger, and discharges the water through the engine exhaust system.

(1) Raw Water Intake - is a tube mounted to the bottom of the boat inside the hull. It contains a removable screen for removing large debris from the water. Water enters it through holes in the hull. The top of the tube is above the deep water line (DWL) to allow cleaning of the screen when the boat is in the water.

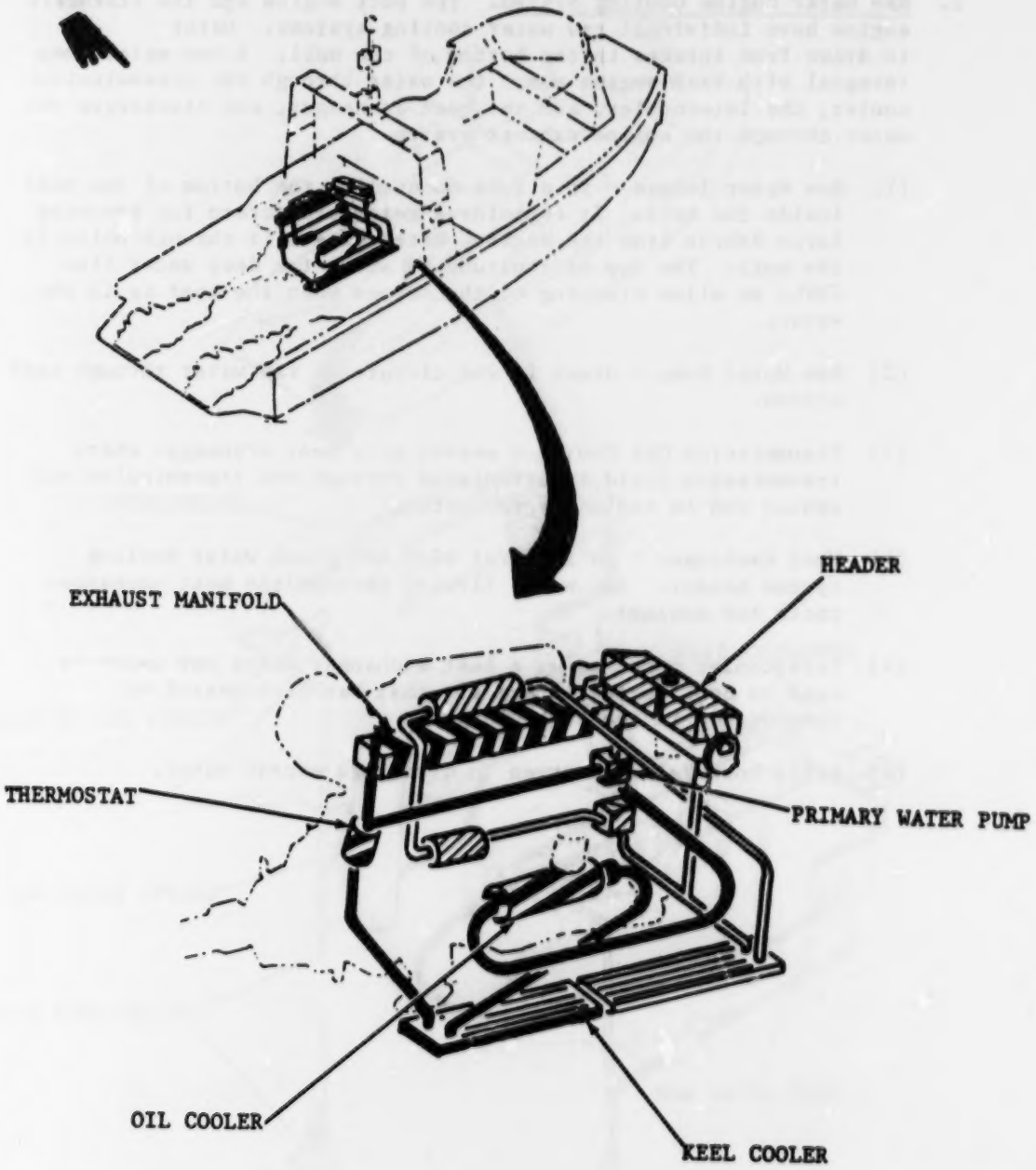
(2) Raw Water Pump - draws in and circulates raw water through each system.

(3) Transmission Oil Cooler - serves as a heat exchanger where transmission fluid is circulated through the transmission oil cooler and is cooled by raw water.

(4) Heat Exchanger - is integral with the fresh water cooling system header. Raw water flowing through the heat exchanger cools the coolant.

(5) Intercooler - serves as a heat exchanger where raw water is used to cool engine intake air that has been heated by compression in the turbocharger.

(6) Drain Down Valve - serves to discharge excess water.



MK2 PRIMARY ENGINE COOLING SYSTEM

1-13. MK2 ENGINE COOLING SYSTEM

a. Primary Engine Cooling System. The primary engine cooling system is identical for both port and starboard engines. Coolant flows from the primary water pump through the engine block to the header and through the exhaust manifold to the thermostat where it is diverted to the keel cooler or to the primary water pump. The coolant diverted to the keel cooler flows through the keel cooler to the oil cooler and back to the primary water pump.

(1) Primary Water Pump - circulates coolant through the primary cooling system.

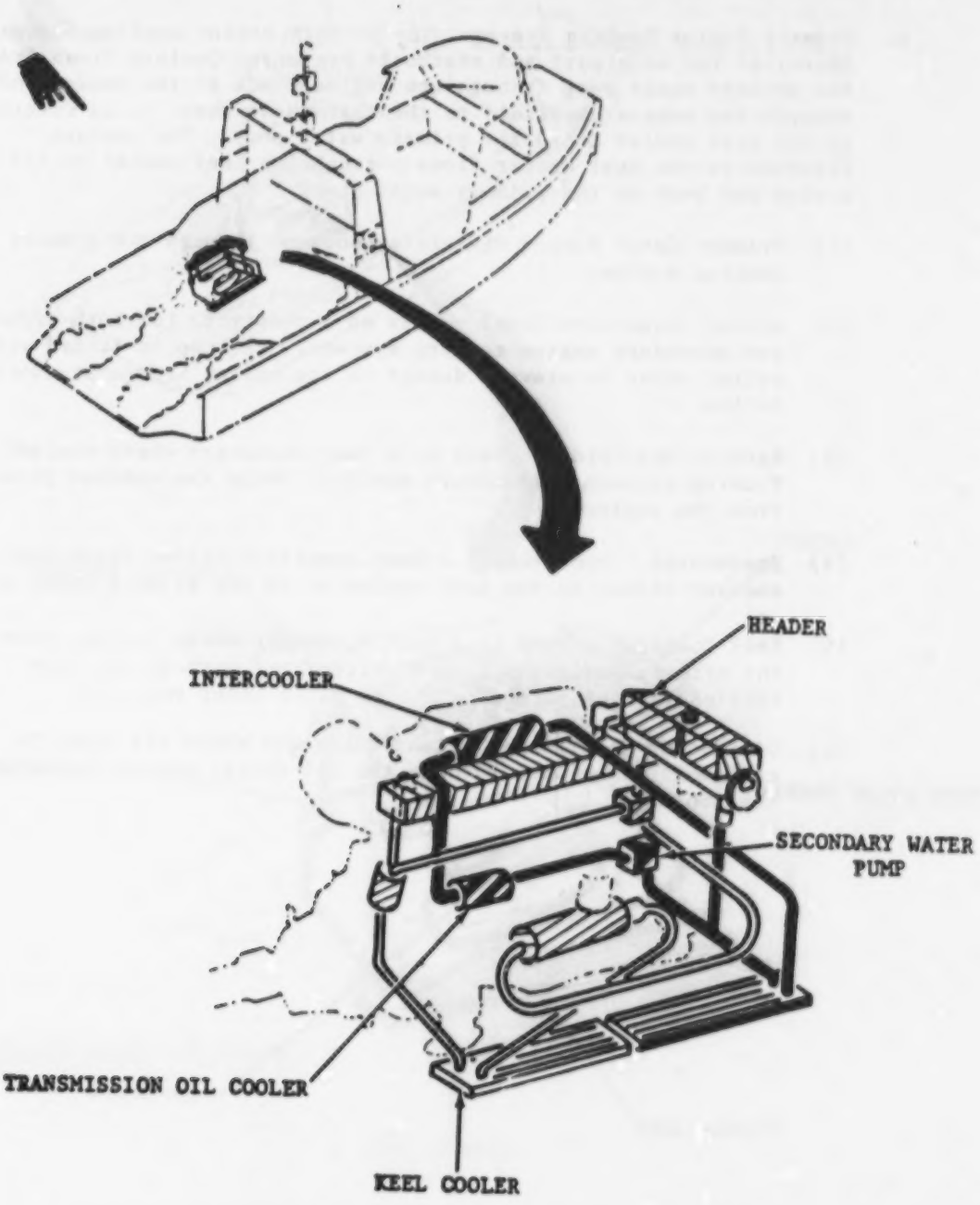
(2) Header (Expansion Tank) - acts as a reservoir for both primary and secondary engine cooling systems. The cap is fitted with a relief valve to prevent damage to the system by overpressurization.

(3) Exhaust Manifold - serves as a heat exchanger where coolant flowing through the exhaust manifold cools the exhaust gases from the engine.

(4) Thermostat - operates as a heat sensitive valve, diverting coolant either to the keel cooler or to the primary water pump.

(5) Keel Cooler - serves as a heat exchanger where coolant from the primary cooling system is circulated through the rear keel cooler and is cooled by raw water under the hull.

(6) Oil Cooler - serves as a heat exchanger where oil from the engine is circulated through the oil cooler and is cooled by the coolant.



MK2 SECONDARY ENGINE COOLING SYSTEM

b. Secondary Engine Cooling System. The port and starboard engines have their own separate secondary engine cooling systems. Coolant flows from the secondary water pump to the transmission oil cooler to the intercooler, and from the intercooler to the keel cooler. The coolant flows from the keel cooler back to the secondary water pump, picking up coolant as needed from the header.

(1) Secondary Water Pump - circulates the coolant through the secondary engine cooling system.

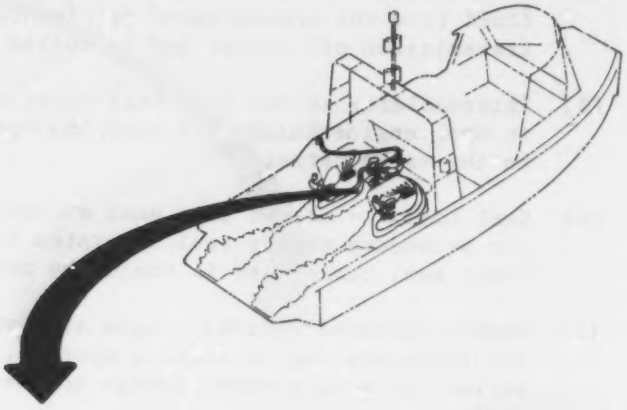
(2) Transmission Oil Cooler - serves as a heat exchanger where fluid from the transmission is circulated through the transmission oil cooler and is cooled by coolant.

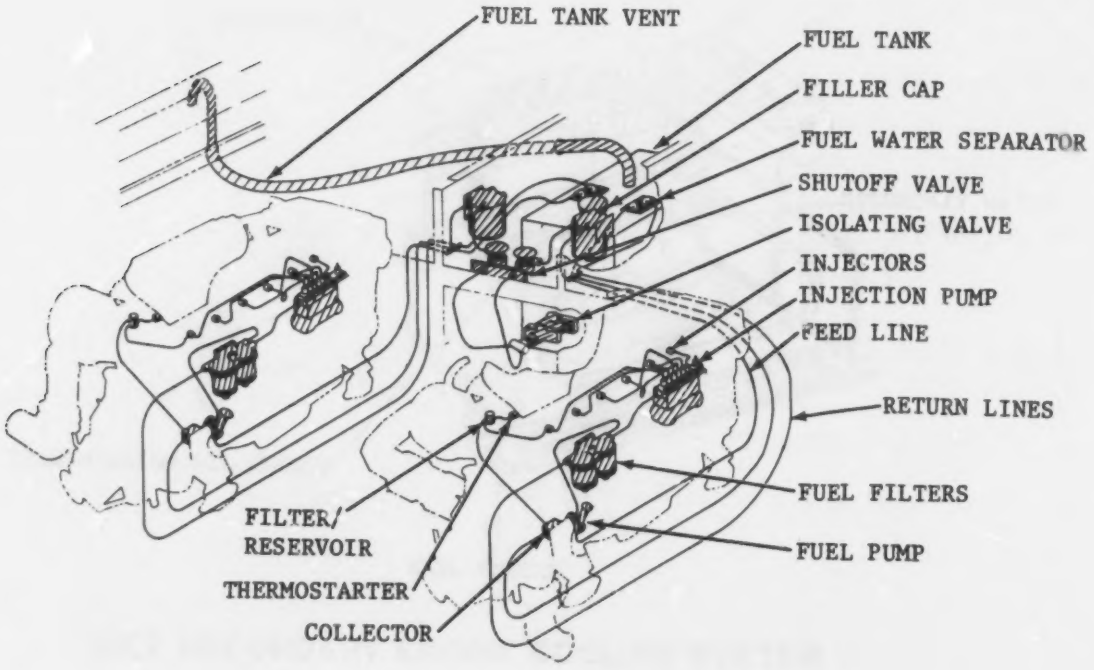
(3) Intercooler - serves as a heat exchanger where coolant is used to cool engine intake air that has been heated by compression in the turbocharger.

(4) Keel Cooler - serves as a heat exchanger where coolant from the secondary engine cooling system is circulated through the front keel cooler and is cooled by the water under the hull.

(5) Header (Expansion Tank) - acts as a reservoir for both primary and secondary engine cooling systems. The cap is fitted with a relief valve to prevent damage to the system by overpressurization.

1-14. FUEL SYSTEM. Each engine has its own fuel system except that fuel is drawn from a common tank. The fuel flows from the tank through fuel water separators to the fuel lift pump mounted on the engine. The fuel is pumped through a fuel filter to the fuel injection pump and then to the injectors. From the fuel filter fuel also goes through a filter/reservoir to the thermostarter. Excess fuel from the fuel filter is returned to the tank. Excess fuel from the fuel injectors and the filter/reservoir is returned to the fuel tank through a collector.





a. Fuel Tank - is located on the centerline of the boat between the battery compartments and slightly forward of the engines. The tank is provided with a vent that vents fumes to the atmosphere and a filler cap for filling the tank. The filler cap has a dipstick for determining the exact amount of fuel in the tank. The tank is designed to prevent an explosion if the tank is penetrated by a bullet.

b. Isolating Valve - is located at the bottom of the tank and is used to isolate the fuel tank from both engines.

c. Shutoff Valve - is located near the top of the fuel tank and is used to isolate the engine from the fuel tank.

d. Fuel Water Separator - is located near the top of the fuel tank and is used to remove water and coarse particles from the fuel.

e. Fuel Tank Vent - is located next to the filler cap on the tank and extends over to the port side of the boat.

f. Feed and Return Lines - are the nylon tubing that connect the engines to the fuel tank. The feed line supplies fuel to the engine. The return lines return excess fuel back to the tank.

g. Fuel Lift Pump - is located on the right side of the engine near the rear mounting brackets. The fuel lift pump supplies fuel to the injection pump during start-up and operation.

h. Fuel Filters - are the double bowl arrangement above the fuel lift pump. These filters remove particles from the fuel that could clog the injection pump or the injectors.

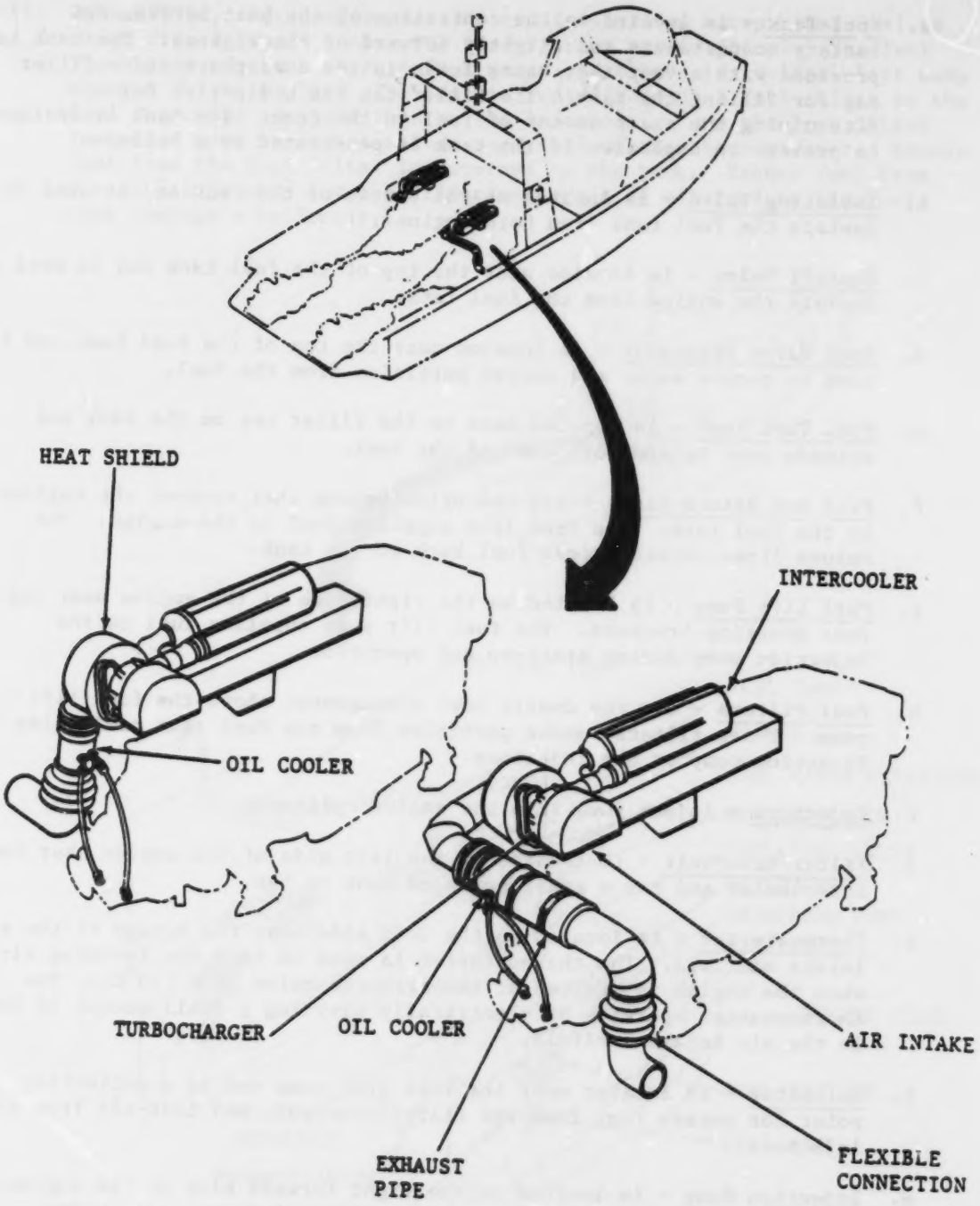
i. Injectors - inject fuel into the engine cylinders.

j. Filter/Reservoir - is located on the left side of the engine near the intercooler and has a small screened knob on top.

k. Thermostarter - is located on the left side near the bottom of the air intake manifold. The thermostarter is used to heat the incoming air when the engine is started at temperatures below 50°F (10°C). The thermostarter operates by electrically igniting a small amount of fuel in the air intake manifold.

l. Collector - is located near the fuel lift pump and is a collecting point for excess fuel from the filter/reservoir and leak-off from the injectors.

m. Injection Pump - is located on the right forward side of the engine. It delivers an accurately measured quantity of diesel oil, under pressure, to the injector through which the fuel is injected into the engine cylinder.


HEAT SHIELD
INTERCOOLER
OIL COOLER
TURBOCHARGER
OIL COOLER
AIR INTAKE
EXHAUST PIPE
FLEXIBLE CONNECTION

1-15. AIR-EXHAUST SYSTEM. The port engine and the starboard engine have individual air-exhaust systems. The systems are identical except that the port engine discharges exhaust gases to port and the starboard engine discharges exhaust gases to starboard. Both port and starboard exhaust systems are cooled by raw water. The MK1 and MK2 exhaust systems differ in two ways. On the MK1 exhaust system, the transmission oil cooler is cooled by the raw water system. On the MK2, it is cooled by the fresh water system. The MK1 exhaust is cooled by water from the raw water cooling system. The MK2 exhaust is cooled by water from the hydrojet.

a. Air Intake - draws air for combustion from the engine compartment. The air intake contains filters that remove particles from the air that could cause engine damage.

b. Turbocharger - draws a large amount of air (approximately 360 cubic feet per minute) and supplies it to the intercooler where it is cooled before entering the intake manifold. The turbocharger is driven by exhaust gas expanding through a turbine wheel.

c. Heat Shield - encloses the turbocharger's turbine housing which operates at high temperature. The heat shield contains insulation, but may cause burns if touched during, or immediately after extensive operation of the engine.

d. Exhaust Pipe - carries the exhaust gases to the flexible connection and on to the exhaust port on the side of the boat at water level. The exhaust gases are cooled by raw water from the raw water cooling system. The raw water enters the exhaust pipe just after the point where gases leave the turbine housing.

e. Flexible Connection - is a short piece of bellows-type rubber tubing used to isolate the engine from the hull.

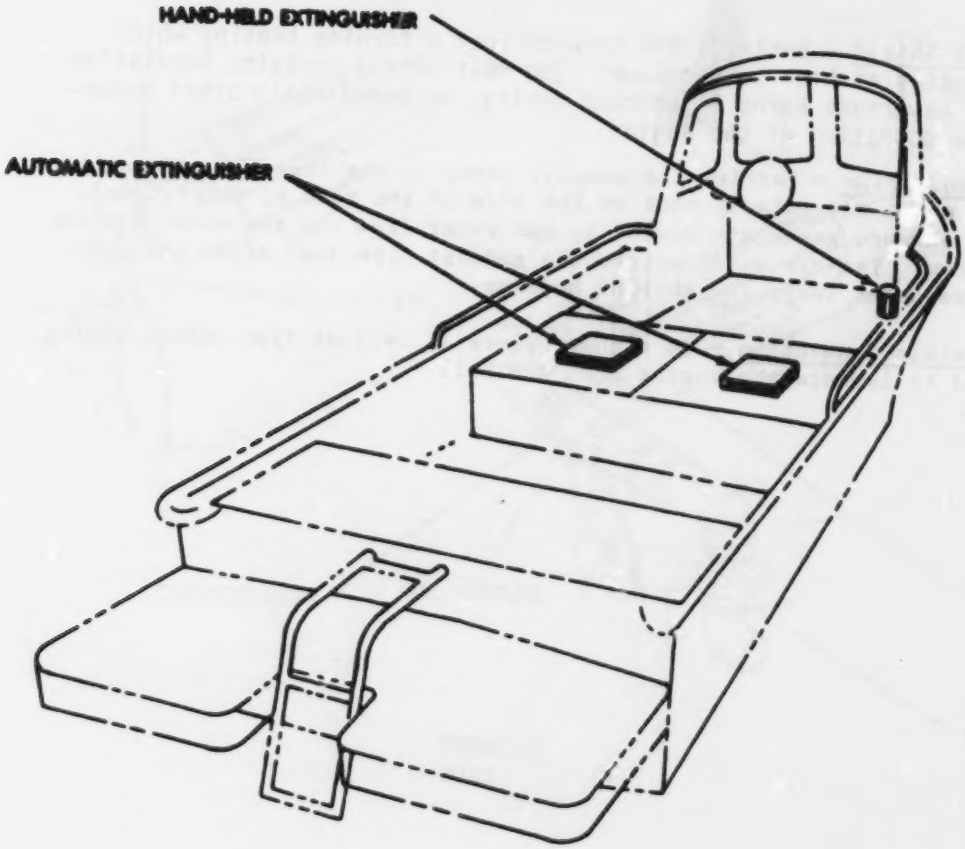
1-16. FIRE EXTINGUISHING SYSTEM

WARNING

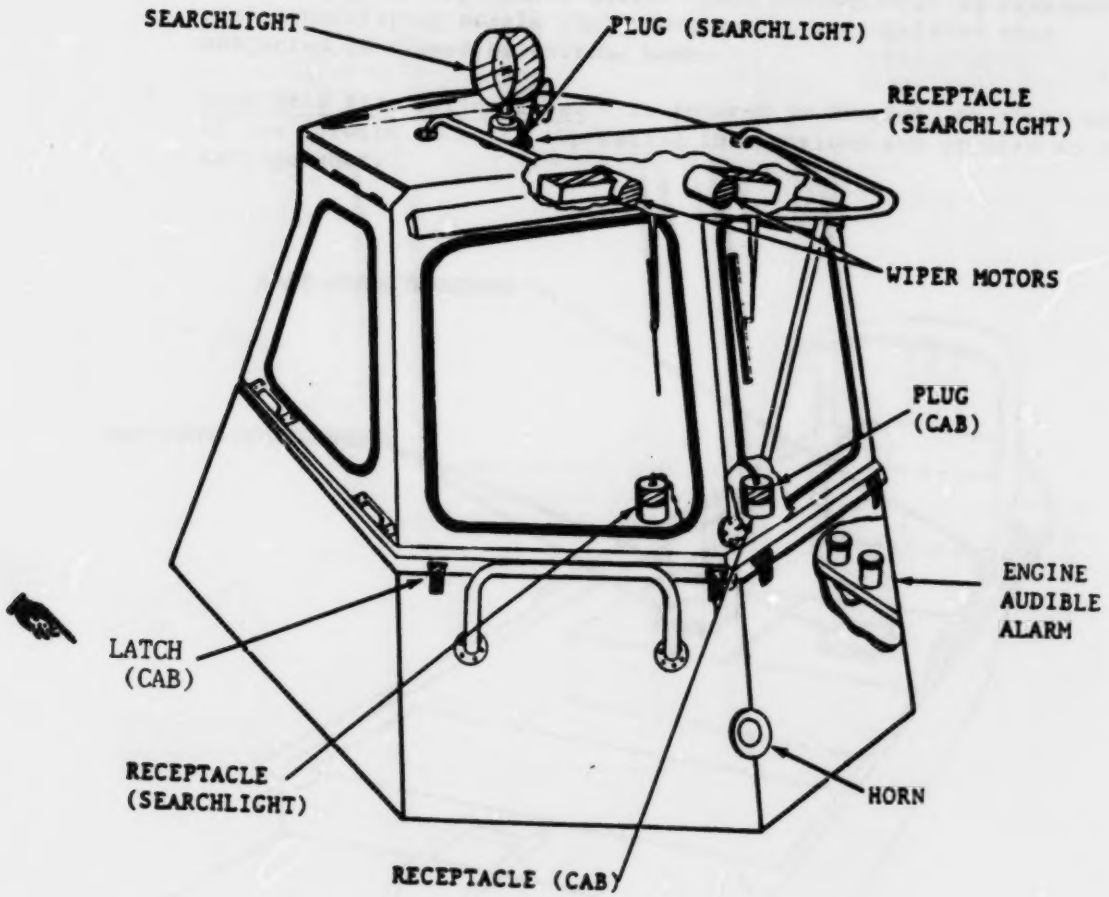
Engine hatch covers must be closed to allow fire extinguishers to extinguish fire. Death or personal injury could result from failure to observe precaution.

a. Automatic Operated Fire Extinguishers - are located on the underside of each engine compartment hatch. Each extinguisher is equipped with sensor/spray nozzle that operates the extinguisher when subjected to flames or extreme heat.

b. Hand-Held Fire Extinguisher - is located in bracket, on right side of the forward cockpit. Operating instructions are printed on the extinguisher.



1-17. **ELECTRICAL SYSTEM.** The boat electrical system is 24 vdc. Two 12 volt batteries are connected in series. There are two sets of batteries for power. An alternator is fitted to each engine for charging the batteries. The circuits are arranged so that EITHER alternator can charge EITHER set of batteries automatically. Power is drawn from the batteries by two separate circuits. The batteries on the port side power the starter motor of both engines and the port engine instruments. The batteries on the starboard side power the starboard engine instruments and the auxiliary circuits.

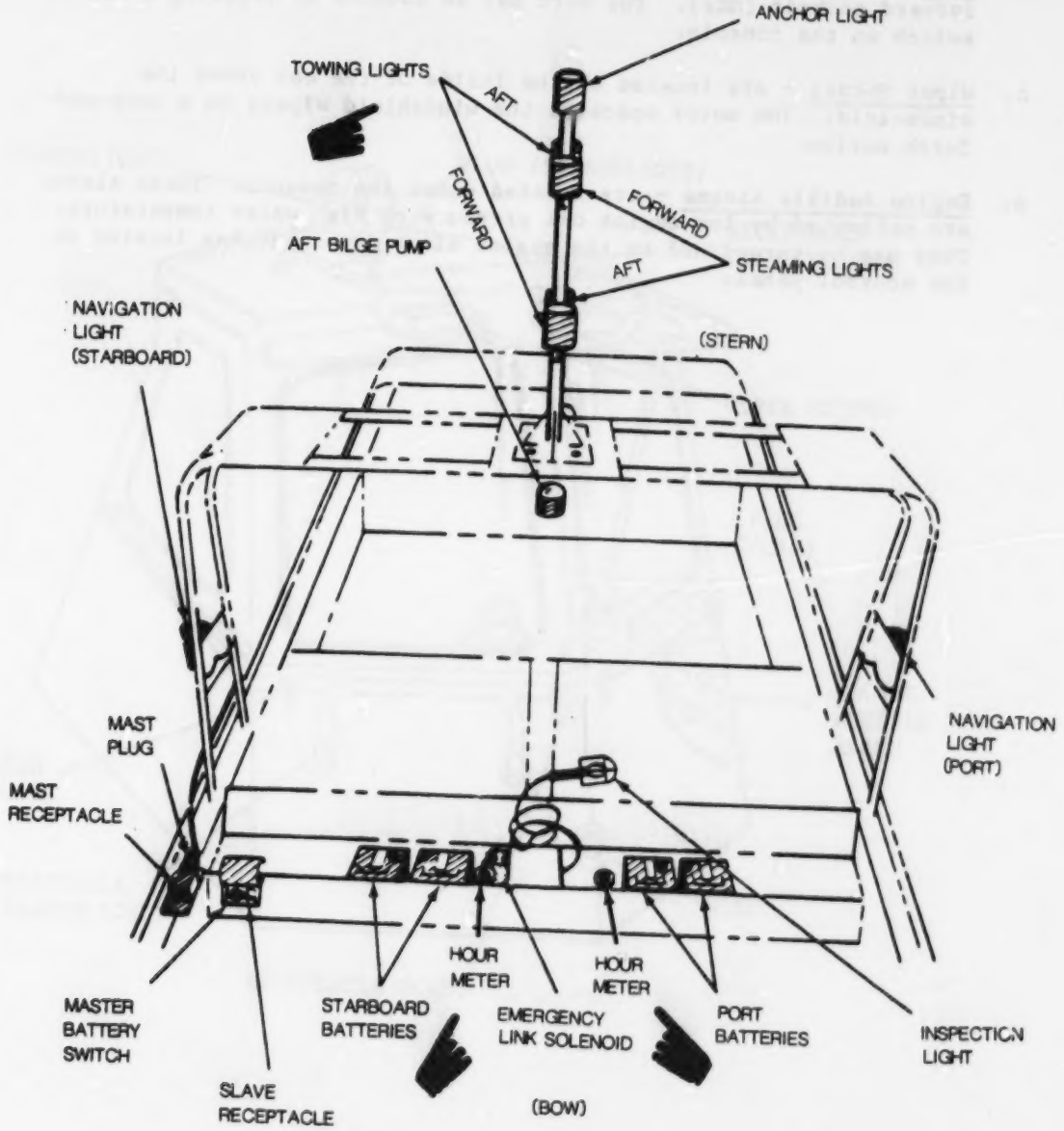

SEARCHLIGHT
PLUG (SEARCHLIGHT)
RECEPTACLE (SEARCHLIGHT)
WIPER MOTORS
PLUG (CAB)
ENGINE AUDIBLE ALARM
LATCH (CAB)
RECEPTACLE (SEARCHLIGHT)
HORN
RECEPTACLE (CAB)

a. Searchlight - can be located on either the top of the cab (as shown) or on the console when the cab is removed. The searchlight can be used as both a floodlight and spotlight.

b. Horn - is located under the console (MK1) or on the front of the forward cockpit (MK2). The horn may be sounded by pressing a button switch on the console.

c. Wiper Motors - are located on the inside of the cab above the windshield. The motor operates the windshield wipers in a back-and-forth motion.

d. Engine Audible Alarms - are located under the console. These alarms are activated by low engine oil pressure or high water temperature. They may be turned off by the engine alarm mute switches located on the control panel.


ANCHOR LIGHT
TOWING LIGHTS
AFT
FORWARD
FORWARD
AFT
STEAMING LIGHTS
AFT BILGE PUMP
NAVIGATION LIGHT (STARBOARD)
(STERN)
MAST PLUG
MAST RECEPTACLE
NAVIGATION LIGHT (PORT)
HOUR METER
HOUR METER
MASTER BATTERY SWITCH
STARBOARD BATTERIES
EMERGENCY LINK SOLENOID
PORT BATTERIES
INSPECTION LIGHT
SLAVE RECEPTACLE
(BOW)

e. Anchor Light - is located on top of the mast and is to be lit when boat is anchored. The light is white.

f. Towing Lights - are to be lit when the boat has a load under tow. There are two towing lights. One towing light is a white light located on the forward side of the mast below the streaming light. The other towing light is a yellow light on the aft side of the mast just below the anchor light.

g. Steaming Lights - are located on the lower part of the mast and are to be lit when the boat is underway. Both lights are white.

h. Navigation Lights - are located on both sides of the mast. The starboard light is green and the port light is red.

NOTE

The anchor, towing, steaming and navigation lights are not intended for use under combat conditions. They are intended for use in waters subject to boat traffic.

i. Electric Bilge Pumps - are for pumping out water that has collected inside the hull. One pump is located in the engine compartment and one pump is located in the hydrojet compartment.

j. Inspection Light - is an extension light located in the engine compartment.

k. Batteries - are located in the battery compartment and supply the electrical power.

l. Hour Meters - are located in the battery compartment and record the number of hours the engines are operated.

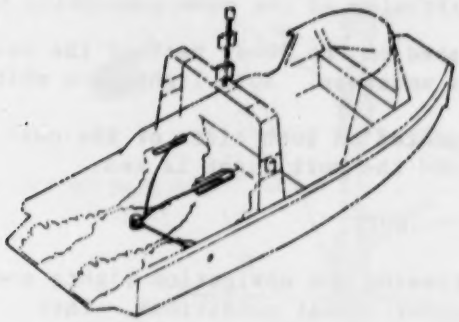
m. Emergency Link Solenoid - is located in the battery compartment and is used to connect both pairs of batteries in parallel when additional power is required to start the engines.

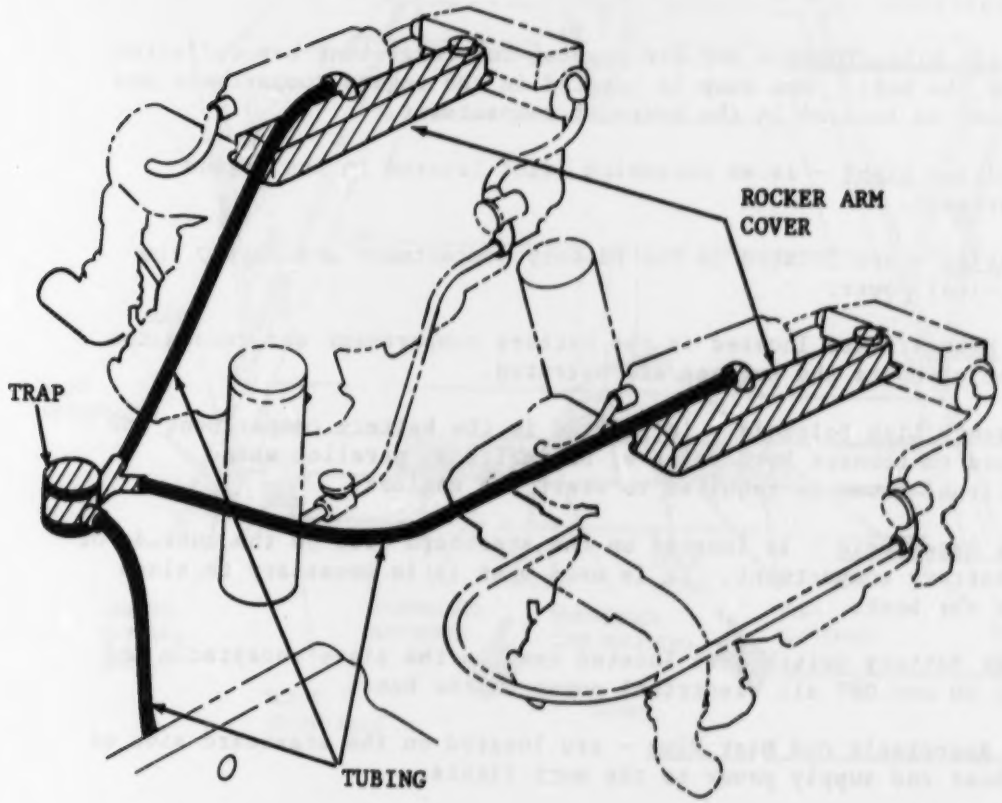
n. Slave Receptacle - is located on the starboard side on the outside of the battery compartment. It is used when it is necessary to slave start the boat.

o. Master Battery Switch - is located next to the slave receptacle and turns ON and OFF all electrical power on the boat.

p. Mast Receptacle and Mast Plug - are located on the starboard side of the boat and supply power to the mast lights.

1-18. ENGINE BREATHING SYSTEM. Each engine is equipped with a breathing tube located on top of the rocker arm cover. A flexible tube from each engine goes to a central point (trap) where condensed vapors are collected. Non-condensed vapors are vented overboard on the starboard side.





CHAPTER 2

OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

NOTE

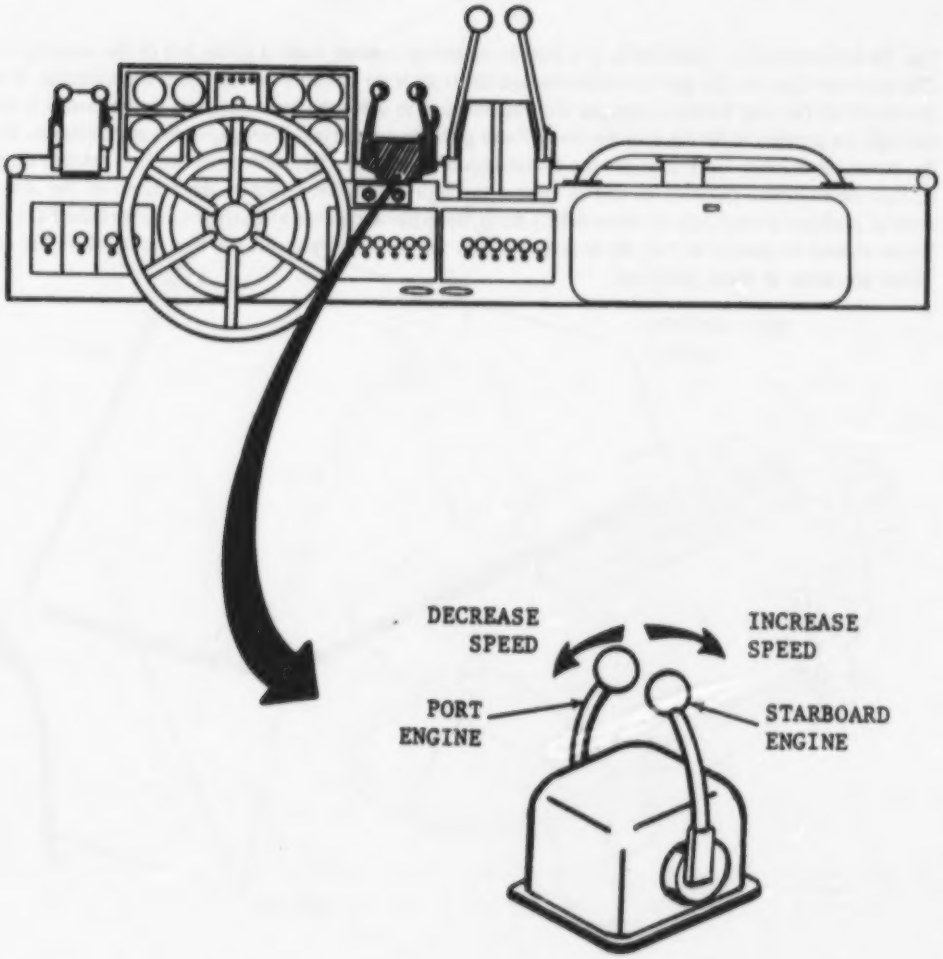
For instructions on launching and retrieving the Bridge Erection Boat refer to TM 5-2090-202-12&P.

CAUTION

The reverse position is used only to clean debris from the grille and is not to be used to control the boat.

2-1. The TRANSMISSION CONTROL is a dual lever action control located to the left of the steering wheel. The left lever controls the port transmission and the right lever controls the starboard transmission. Pushing the levers all the way forward engages the transmission to drive the hydrojet units so that water is ejected through the nozzels at the back of the boat. Putting the levers upright disengages the transmission. Pulling the levers all the way back engages the transmission to drive the hydrojet units but in a reverse direction so that water enters the nozzles and is ejected through the intake grilles at the bottom of the boat. The reverse position is used only to clean debris from the grille and is not to be used to control the boat. These levers should be placed in only three positions: all the way forward, all the way back, or in the center. There are stops at these positions.

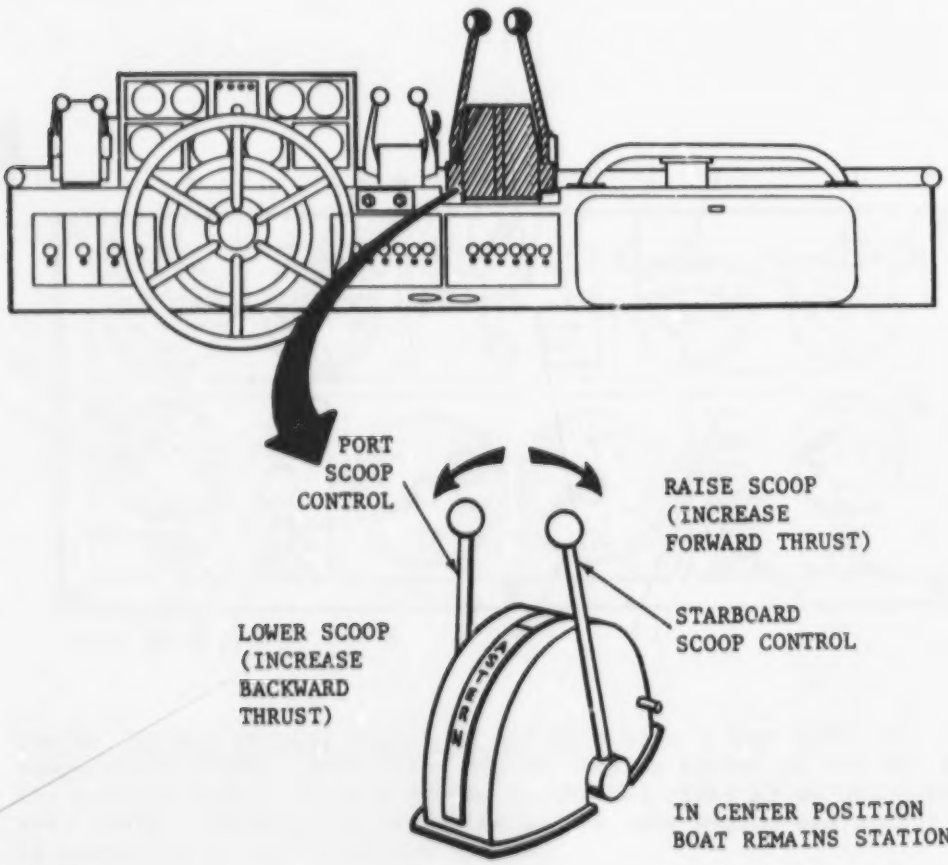
2-2. The ENGINE THROTTLE CONTROL is a dual lever action control located to the right of the steering wheel. The left lever controls the port engine rpm and the right lever controls the starboard engine rpm. Pulling the levers all the way back puts the engines at idle speed. Pushing the levers forward increases the engine speed until maximum speed is reached when levers are all the way forward.



2-3. The SCOOP CONTROL is the large dual lever action control located to the right of the engine throttle control. The left lever controls the port scoop and the right lever controls the starboard scoop. Putting the levers in the center positions the scoops so that the thrust from the hydrojets is deflected downwards and the boat remains stationary. Pushing the levers forward raises the scoops. This increases the forward thrust and the boat moves forward. Pushing the levers all the way forward allows full forward thrust. Pulling the levers back lowers the scoops and the thrust from the hydrojets is deflected forward and the boat moves backwards. Pulling the levers all the way back allows full backward thrust. The levers can be set at any position from full forward to full back. Levers can be operated independently of each other for effective steering at low engine rpm.

CAUTION

Scoop Control Levers should not be moved at high engine rpm. Linkage damage may result.

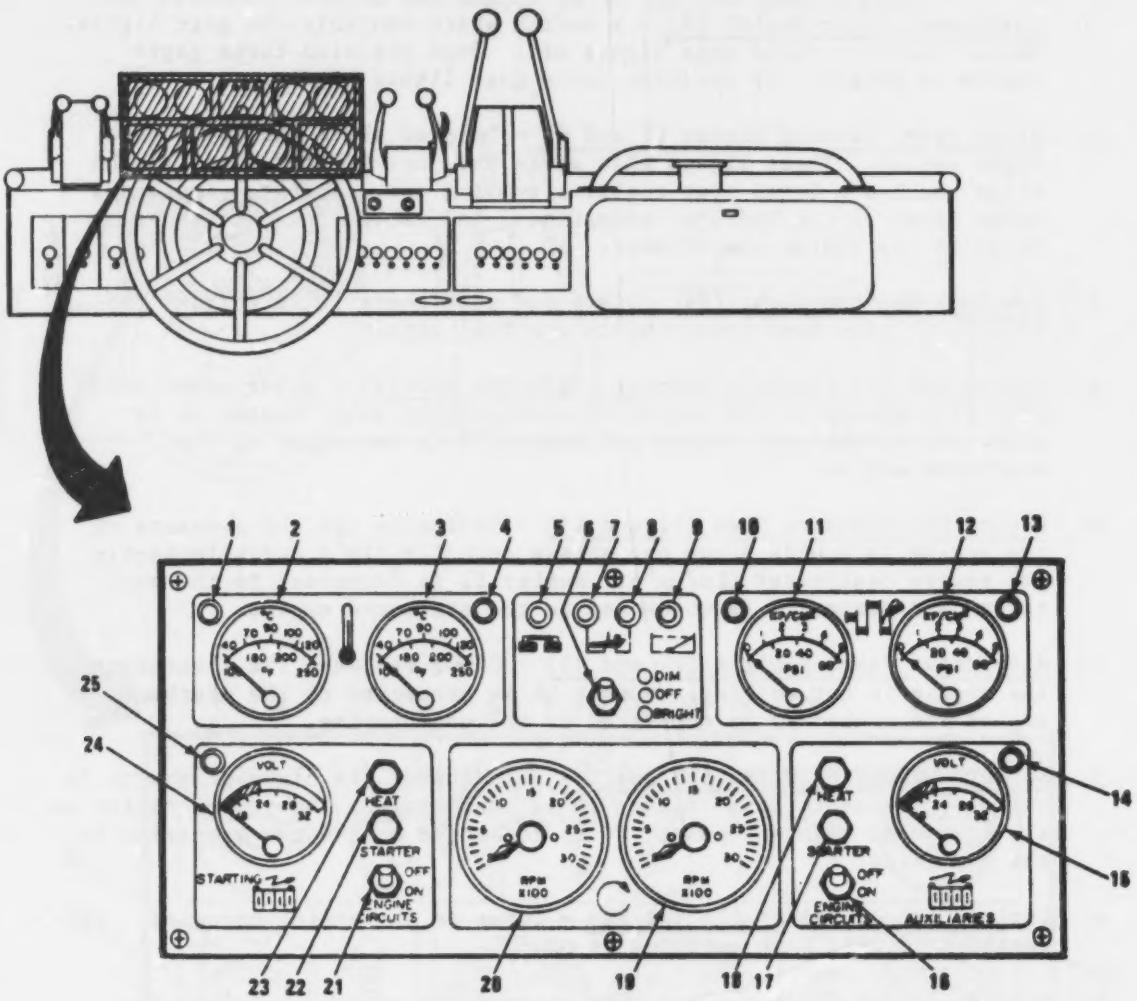


CAUTION

Care must be taken when loosening the adjustment knob, not to unscrew it. Disassembly of the steering wheel assembly may be required to get the knob back in position.

2-4. The STEERING WHEEL and SCOOP POSITION INDICATOR are located on the left side of the control panel. Turning the wheel to port (counterclockwise) tilts the nozzles and scoops to port and the boat turns to port. Turning the wheel to starboard (clockwise) tilts the nozzles and scoops to starboard and the boat turns to starboard. When the wheel is centered, the nozzles and scoops are centered and the boat goes straight ahead. The scoop position indicator is directly behind the hub of the steering wheel. The indicator has a centermark and a scale starting with 0 in the center. When the wheel is turned the scale moves under the centering mark. When the wheel is centered, 0 appears under the mark. The scale is used to determine the approximate position (port-center-starboard) of the scoops. Directly below the scoop position indicator is a steering damper adjustment knob. Tightening or loosening this knob adjusts a brake on the steering wheel shaft. This adjustment makes the steering wheel harder or easier to turn. The operator may choose the exact adjustment. Care must be taken when loosening the adjustment knob not to unscrew it. Disassembly of the steering wheel assembly may be required to get the knob back in position.

2-5. The ENGINE INSTRUMENT PANEL is located directly in front of the steering wheel and contains the following switches, gages, and lights necessary to start and monitor the engines:



a. Engine Coolant Warning Lights (1 and 4) - Glow orange when the temperature of the fresh water engine cooling system on the MK1 or the primary engine cooling system on the MK2 rises to an unacceptable level. Number 1 is connected to the port engine and number 4 is connected to the starboard engine.

b. Coolant Temperature Gage (2 and 3) - Indicates the temperature in degrees Fahrenheit and Celsius of the fresh water engine cooling system on the MK1 and of the primary engine cooling system on the MK2. Number 2 is connected to the port engine and number 3 to the starboard engine.

c. Emergency Link Warning Light (5) - Glows red when the emergency link switch on auxiliary switch panel no. 1 is turned on.

d. Instrument Light Switch (6) - A switch which controls the gage lights. Center position turns gage lights off. Down position turns gages lights on bright. Up position turns gage lights on dim.

e. Bilge Water Warning Lights (7 and 8) - Located above the instrument light switch. These lights glow green when accumulated water in the bilge reaches a level that requires pumping out. Number 7 indicates water level in the hydrojet compartment and number 8 indicates water level in the engine compartment.

f. Low Fuel Warning Light (9) - Glows red when there is 12 gallons (45 liters) or less fuel remaining in the fuel tank.

g. Engine Low Oil Pressure Warning Light (10 and 13) - Glows amber when the oil pressure in the engine is unacceptably low. Number 10 is connected to the port engine and number 13 is connected to the starboard engine.

h. Engine Oil Pressure Gage (11 and 12) - Indicates the oil pressure of the engine in pounds force per square inch (lb_f/in^2) and kilopascals per square centimeter (Kp/cm^2). Number 11 is connected to the port engine and number 12 is connected to the starboard engine.

i. Alternator Warning Light (14 and 25) - Glows red when the alternator on the engine is not working. Number 14 is connected to the starboard engine and number 25 is connected to the port engine.

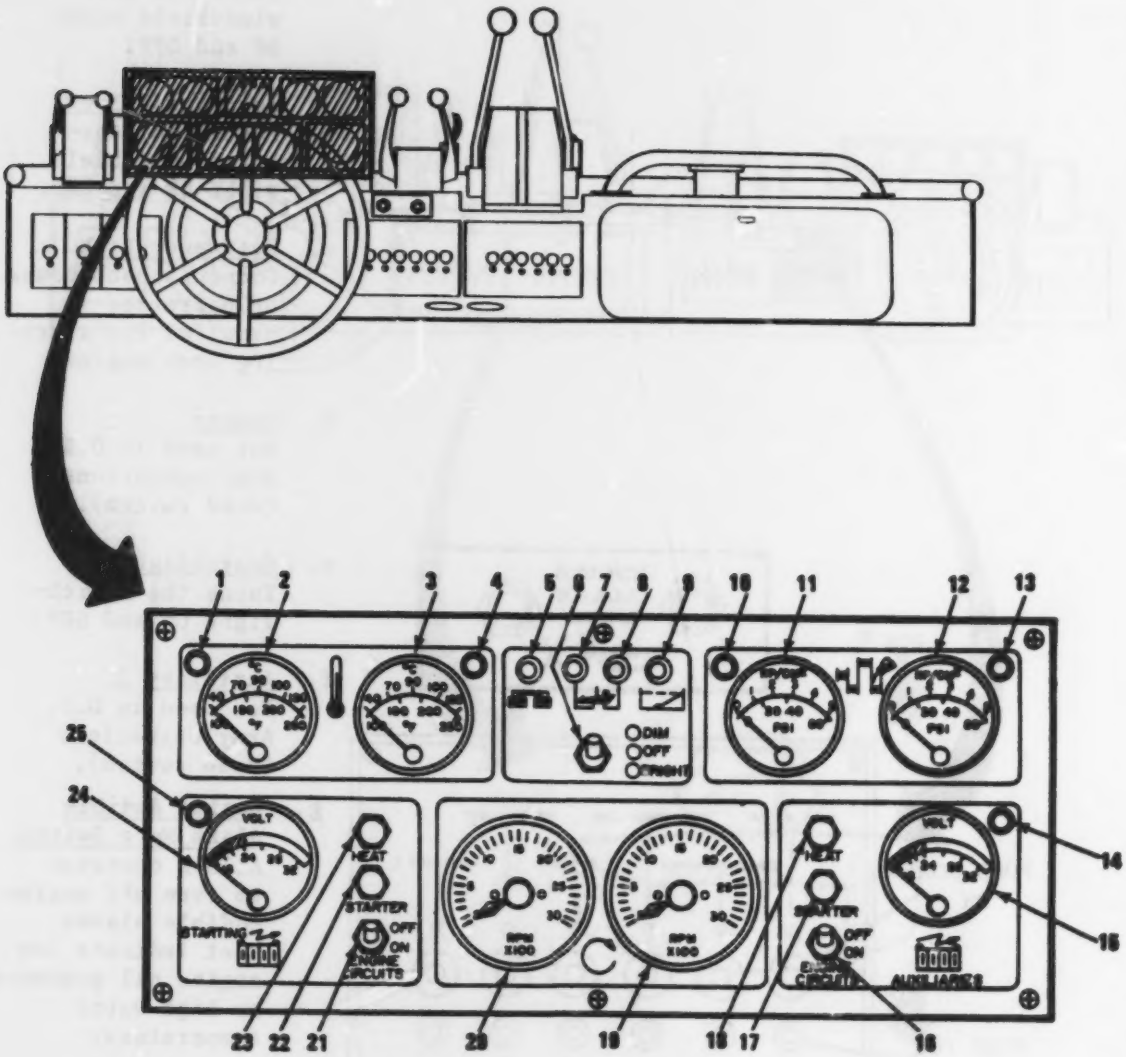
j. Battery Condition Meter (15 and 24) - Indicates the state of charge in volts of the batteries. Number 15 is connected to the two batteries on the starboard side and number 24 is connected to the two batteries on the port side.

k. Engine Circuit Switch (16 and 21) - Turns on the engine circuits. Up position is OFF, down position is ON.

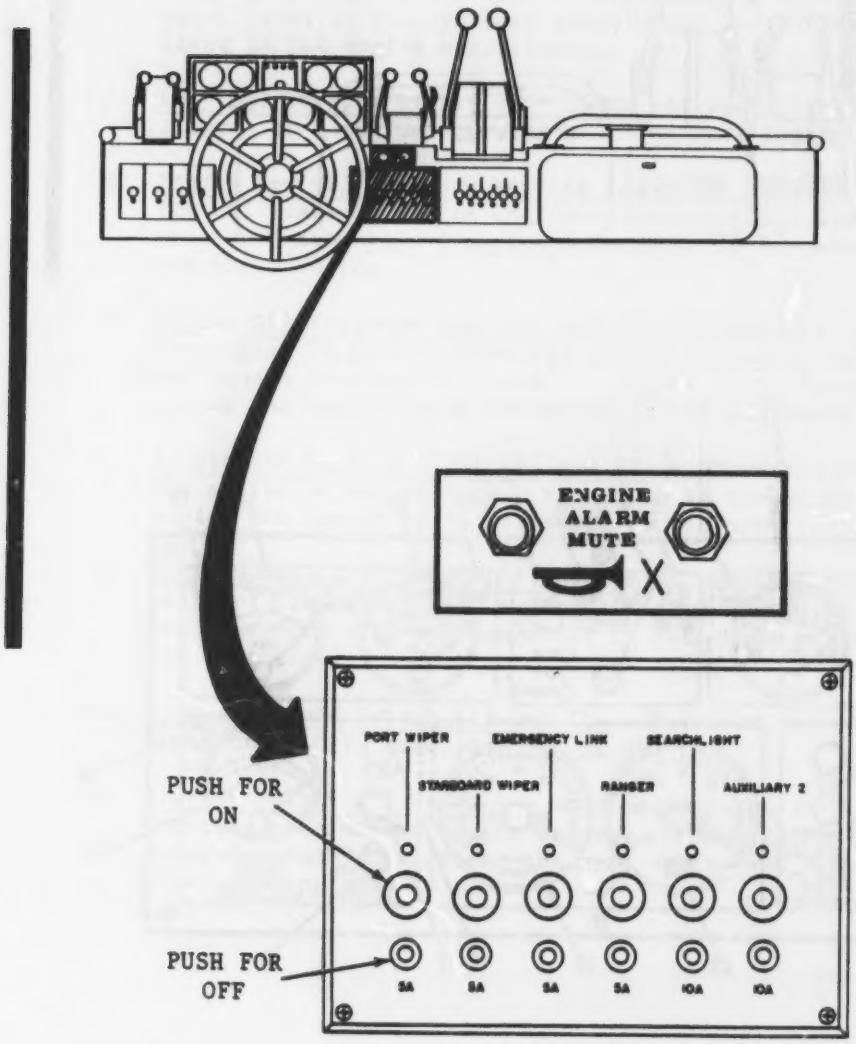
l. Starter Switch (17 and 22) - When pressed the switch activates the starting motor to start the engine. Switch functions as long as it is pressed. Number 21 is for the port engine and number 17 is for the starboard engine.

m. Heat Switch (18 and 23) - When pressed the switch activates the thermostart unit used for engine starting at temperatures below 50°F (10°C). Switch functions as long as it is pressed. Number 23 is for the port thermostart unit and number 18 is for the starboard thermostart unit.

n. Tachometer (19 and 20) - Indicates the speed of the engine crankshaft in rpm. Actual speed is scale reading times 100. Number 19 is for the starboard engine and number 20 is for the port engine.



2-6. The AUXILIARY SWITCH PANEL NO. 1 is the bank of switches located to the right of the steering wheel and farthest from the steering wheel. This panel incorporates miniature circuit breakers that control electrical services in the boat. The switches include a large button, a small button and a miniature light above the large button. The large button is pushed to turn on the electrical circuit. When the circuit is on, the miniature light is lit. The small button is pushed to turn off the circuit. When a circuit breaker is tripped, pushing the large button will reset the breaker. The switches are identified and control the following:



a. Port Wiper. Turns the port windshield wiper ON and OFF.

b. Starboard Wiper. Turns the starboard windshield wiper ON and OFF.

c. Emergency Link. Connects both banks of batteries in parallel for starting each engine.

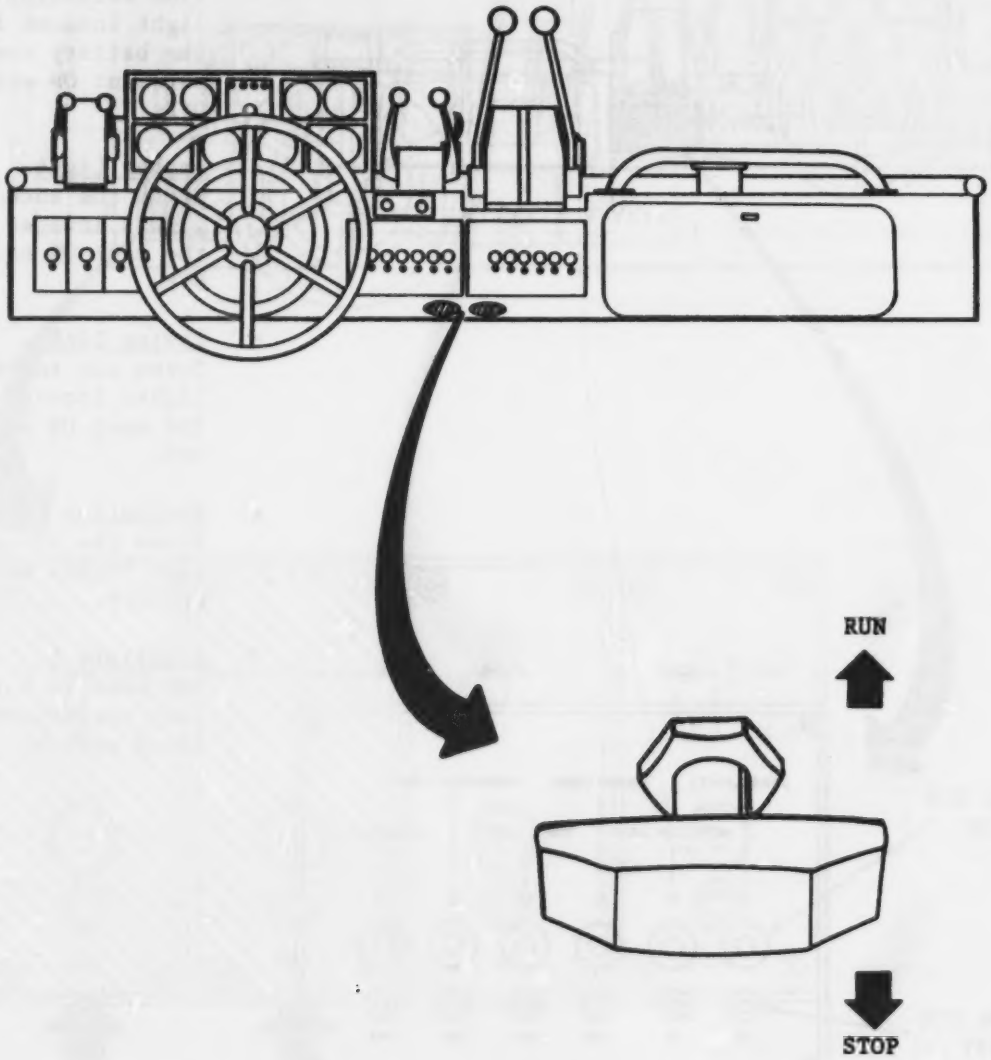
d. Ranger. Not used in U.S. Army operations (dead switch).

e. Searchlight. Turns the searchlight ON and OFF.

f. Auxiliary 2. Not used in U.S. Army operations (dead switch).

g. Engine Audible Alarm Mute Switch. Allows operator to turn off engine audible alarms that indicate low engine oil pressure or high water temperature.

2-7. **The ENGINE STOP CONTROLS are the two T-handle controls located below the auxiliary switch panels. When pushed in the engines will run. When pulled out the engines will stop. The left control is for the port engine and the right control is for the starboard engine. Pulling the engine stop controls out stops the flow of fuel from the injection pump to the injectors.**



2-8. The AUXILIARY SWITCH PANEL NO. 2 is located to the right of the steering wheel and is closest to the steering wheel. The design and operation of switches are identical to those of auxiliary switch panel no. 1. The switches are identified and control the following:

a. Cabin Lights. Turns the map locker interior lights ON and OFF.

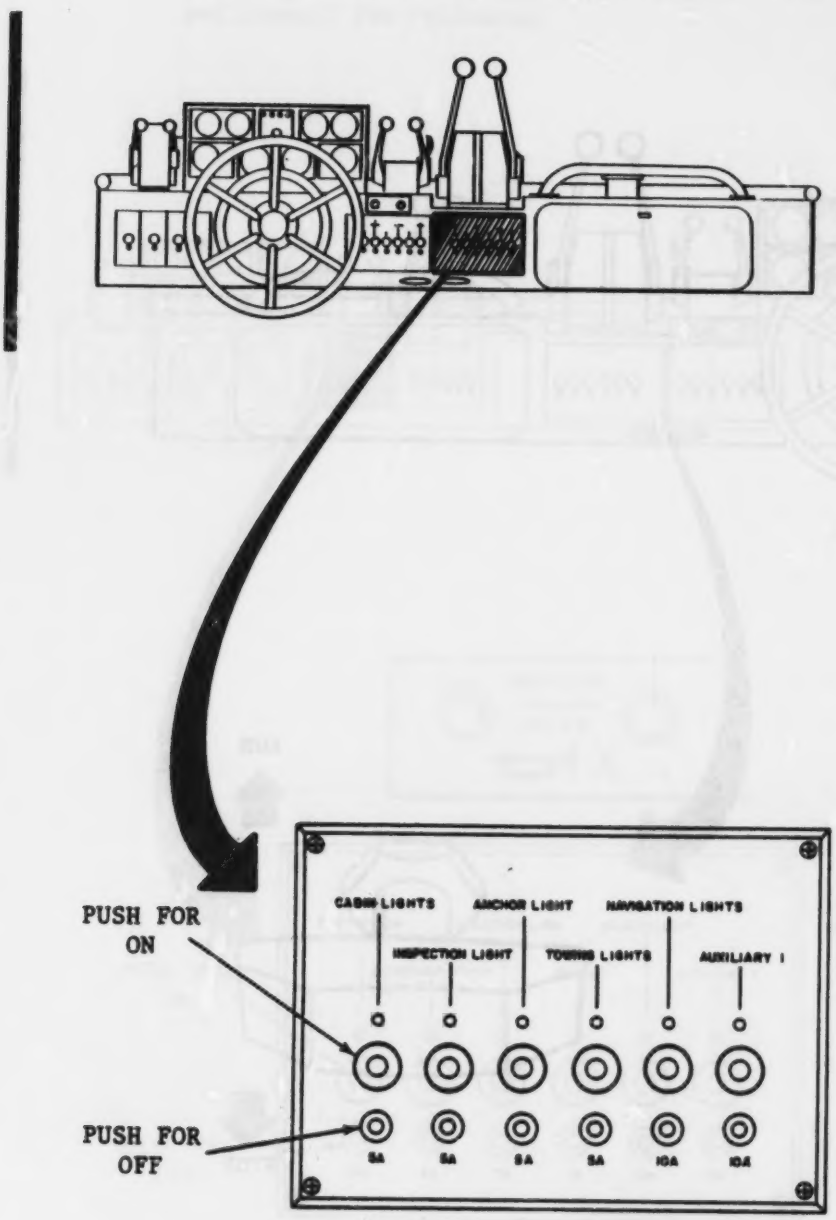
b. Inspection Lights. Turns the inspection extension light located in the battery compartment ON and OFF.

c. Anchor Light. Turns the anchor lights located on the mast ON and OFF.

d. Towing Light. Turns the towing lights located on the mast ON and OFF.

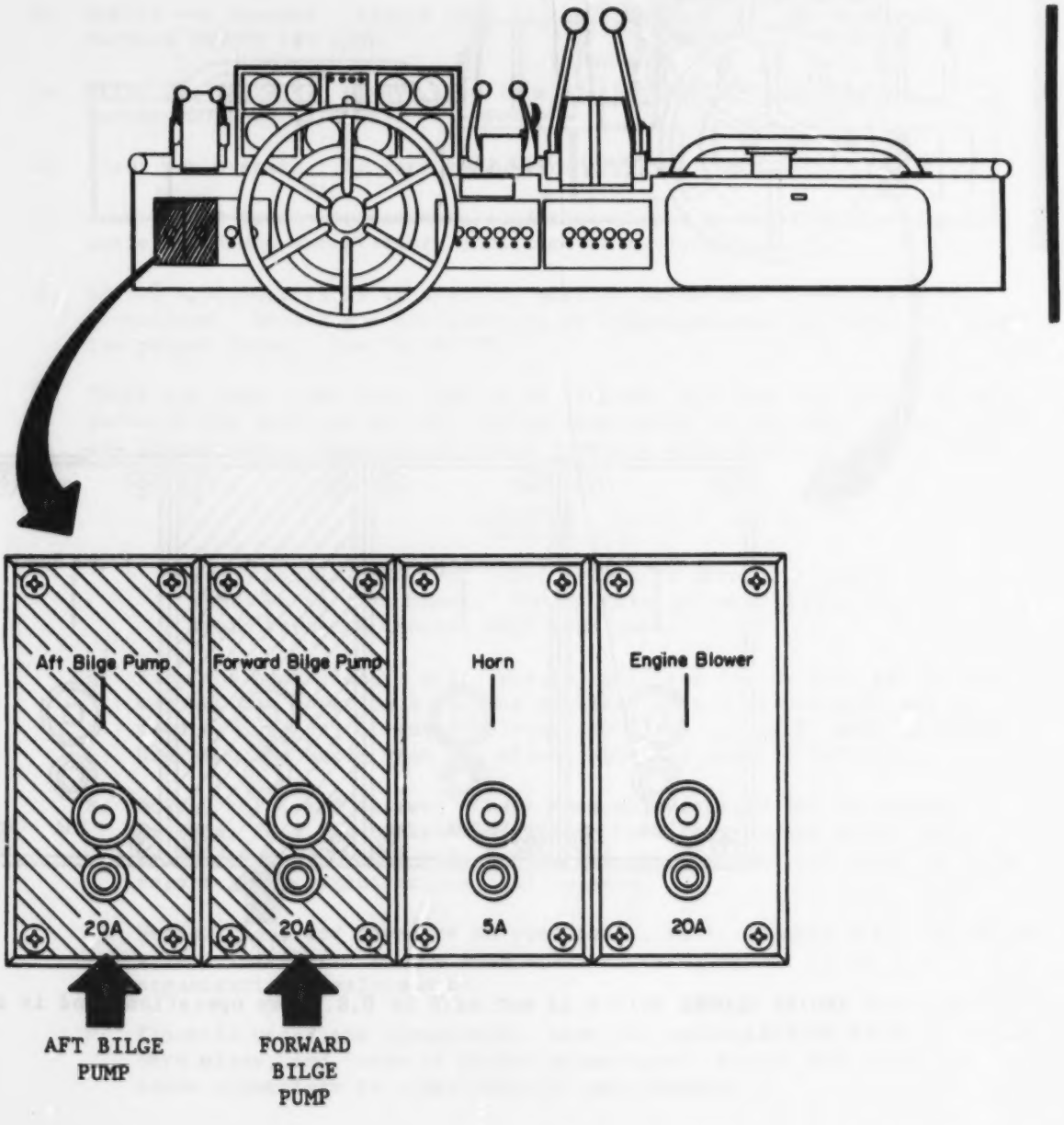
e. Navigation Light. Turns the navigation lights ON and OFF.

f. Auxiliary 1. Not used in U.S. Army operations (dead switch).

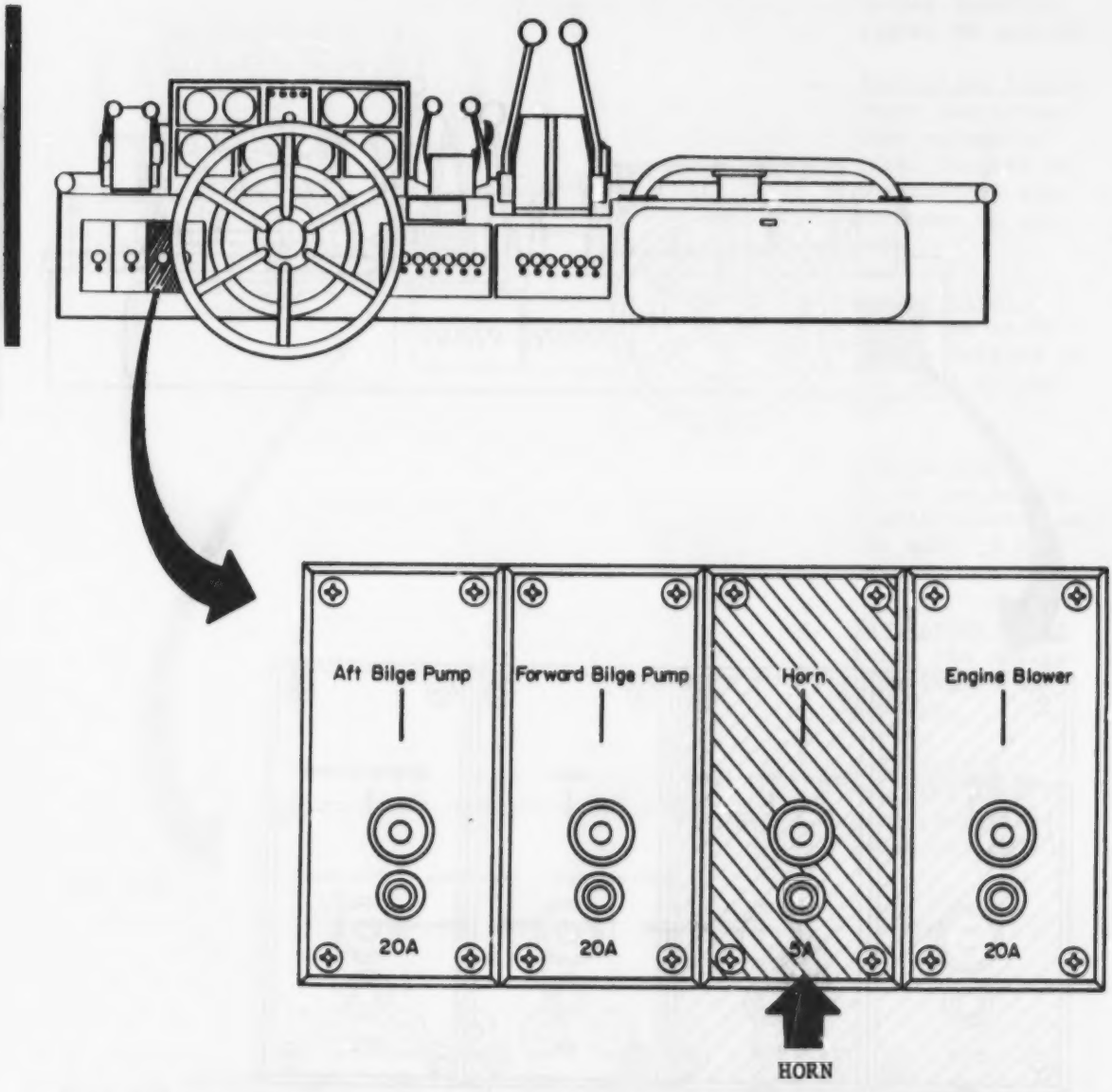


2-9. The AFT BILGE PUMP SWITCH is identical to the switches on auxiliary panel no. 1. The operation of the switch is the same as those for auxiliary panel no. 1. This switch turns the bilge pump located in the hydrojet compartment on and off.

2-10. The FORWARD BILGE PUMP SWITCH is identical to the aft bilge pump switch. This switch turns the bilge pump located in the engine compartment on and off.



2-11. The HORN SWITCH is identical in appearance with the aft bilge pump switch. Only the large button is used. Pressing the large button sounds the horn. As long as the button is held in, the horn will sound. Releasing the large button stops the horn.



2-12. The ENGINE BLOWER SWITCH is not used in U.S. Army operations and is a dead switch.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

General

1. To ensure that the bridge erection boat is ready for operation at all times, inspect it systematically for defects. Correct defects discovered during operation of the unit as soon as operation has ceased. Stop any operation which would damage the unit. Record deficiencies and corrective action taken on DA form 2404, Equipment Inspection and Maintenance Worksheet, at the earliest opportunity.

2. Before you operate. Always keep in mind the CAUTIONS and WARNINGS. Perform BEFORE (B) PMCS.

3. While you operate. Always keep in mind the CAUTIONS and WARNINGS. Perform DURING (D) PMCS.

4. After you operate. Be sure to perform AFTER (A) PMCS.

5. Weekly PMCS is for items whose condition should be checked on a regular basis to insure satisfactory condition or performance.

6. If you equipment fails to operate, perform authorized troubleshooting procedures. Report any deficiencies to organizational maintenance using the proper forms. See TM 38-750.

7. There are some items that need to be checked, but they are common in all parts of the boat and are not listed separately in the PMCS tables. They are listed here. Remember to check them all each time you do your PMCS.

WARNING

Dry cleaning solvent (SD-2) vapor is harmful. Don't breathe in the fumes. Use plenty of ventilation. Avoid repeated contact with your skin.

A. Keep the boat clean: Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal deck surfaces. Use soap and water when you clean rubber or plastic material.

B. Bolts, nuts, and screws: Check them all visually for looseness, missing, bent, or broken condition. Look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, report it to organizational maintenance.

C. Welds: Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a broken weld, report it to organizational maintenance.

D. Electric wires and connectors: Look for cracked or broken insulation, bare wires, and loose or broken connectors. Report bad wires and loose connectors to organizational maintenance.

E. Hoses and fluid lines: Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks and a stain around a fitting or connector can mean a leak. Report broken or leaking hoses or lines to organizational maintenance.

F. Control cables and linkage: Look for frayed or broken cable. Look for bent or broken rods and loose connections. Report damaged or broken cables, bent or broken rods and loose connections to organizational maintenance.

G. Hatches: When opening battery, engine, or hydrojet compartment, inspect the hatches for missing fasteners, hinges, stays. Report any missing or broken components to organizational maintenance.

7. Purpose of inspection is to verify visually that all parts and items are in good condition and operational.

PMCS PROCEDURES

1. Every mission begins and ends with paperwork. There isn't much of it, but you have to keep it up to date. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your boat. They are reports to organizational maintenance and to your commander. And they are a checklist for you when you want to know what is wrong with your boat after its last use, and whether those faults have been fixed. For information you need on forms and records, see TM 38-750.

2. Comments under "Equipment is Not Ready/Available If" column of the PMCS table tell you when the boat should not be operated.

3. During your PMCS, if you run across a condition where the boat is not operational, don't stop your PMCS. Complete all PMCS so that if any other conditions exist, they can be corrected at one time.

4. The PMCS table will tell you what corrections you can do. Do not attempt any other corrections. Conditions listed under "Equipment is Not Ready/Available If" column should be reported to organizational maintenance. See TM 38-750 for form and records required to report these conditions.

Special Instructions

1. Leakage definitions for operator/crew PMCS are as follows:

Class I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II - Leakage of fluid great enough to form drops but not great enough to cause drops to drip from item being checked/ inspected.

Class III - Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

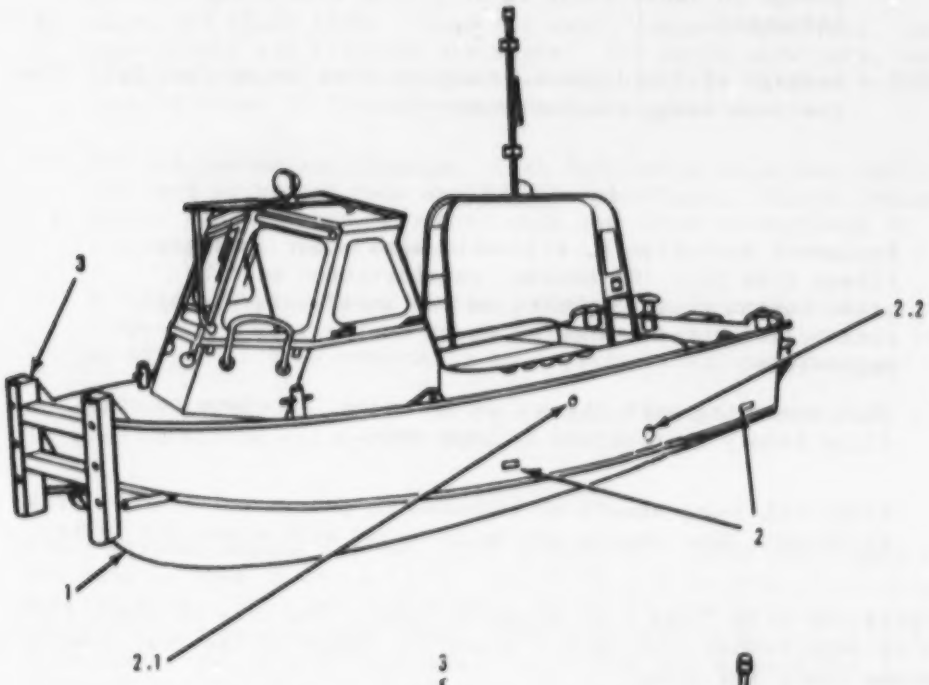
Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to the fluid capacity on the item/system being checked/inspected. When in doubt notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or organization. Boat should not be operated with Class III leaks.

2. When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS. Check the leaks to see that they have not become Class III leaks.

3. Class III leaks should be reported to your supervisor or organizational maintenance. Boat should not be operated with Class III leaks.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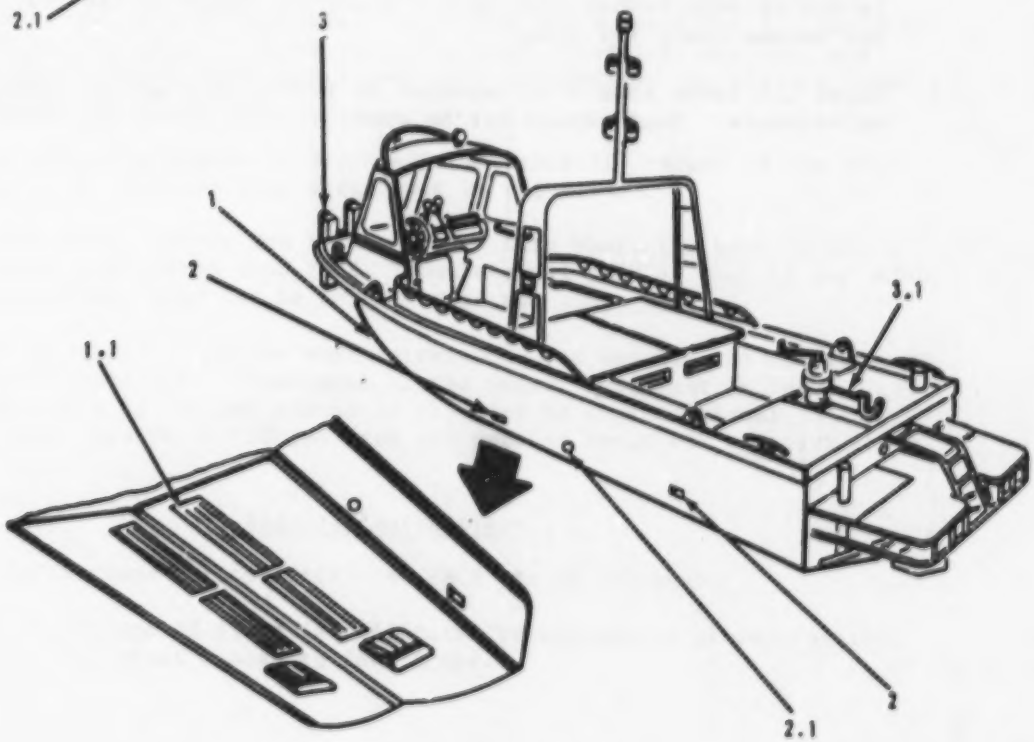
2.2
2
1
2.1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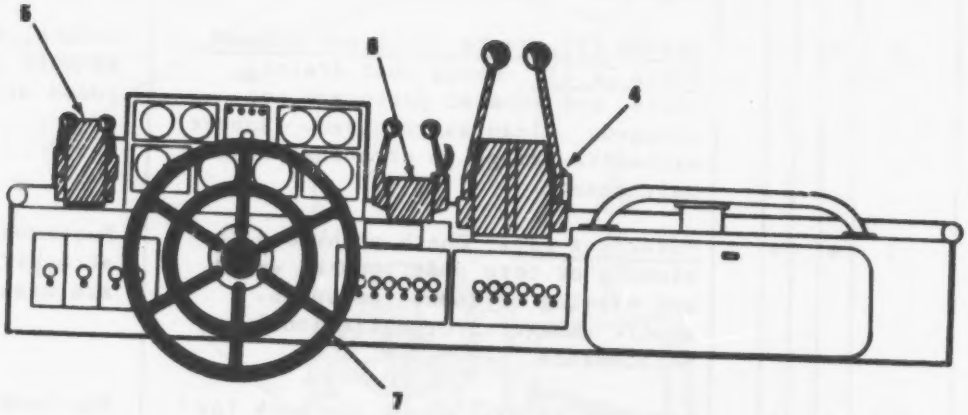
1
2
3.1
1.1
2
2.1

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
1	•	•			Hull Surface (1). Check the hull for cracks, tears, holes, and cracked welds and leaks. Report damage to organizational maintenance.	Hull surface has holes, cracks, tears, or cracked welds.
1.1	•		•		Keel Coolers (MK2 only) (1.1). Check keel coolers for plant growth and debris. Clean as required. Also check for punctures, corrosion, and other damage. Report any damage to organizational maintenance.	Keel coolers are punctured or extremely corroded.
2	•		•		Drains (2), Vents (2.1) and Exhaust Ports (2.2). Check that drains, vents, and exhaust ports are not clogged. Clean as required. Report excessive damage to organizational maintenance.	Drains, vents, or exhaust ports corroded or cracked.
3	•		•		Pushknees (3). Check pushknees for missing or torn pads, broken welds, and missing or loose fasteners. Report damage to organizational maintenance.	Pushknees or attaching hardware are missing.
3.1	•		•		Tow Hook (3.1). Check tow hook for cracks and smooth operation of quick release mechanism. Report cracks or quick release failure to organizational maintenance.	Tow hook is cracked or quick release fails.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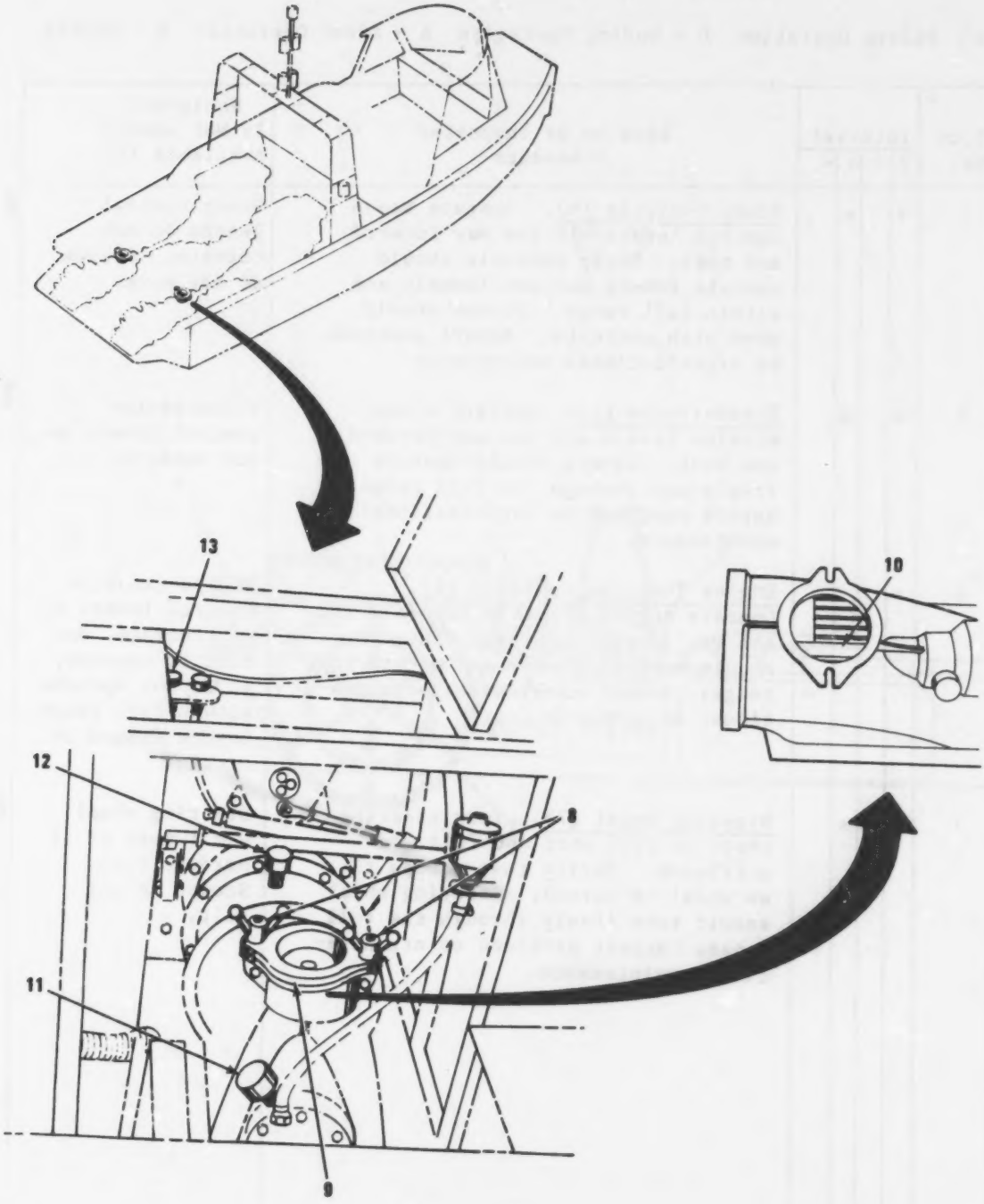
6
4
7

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

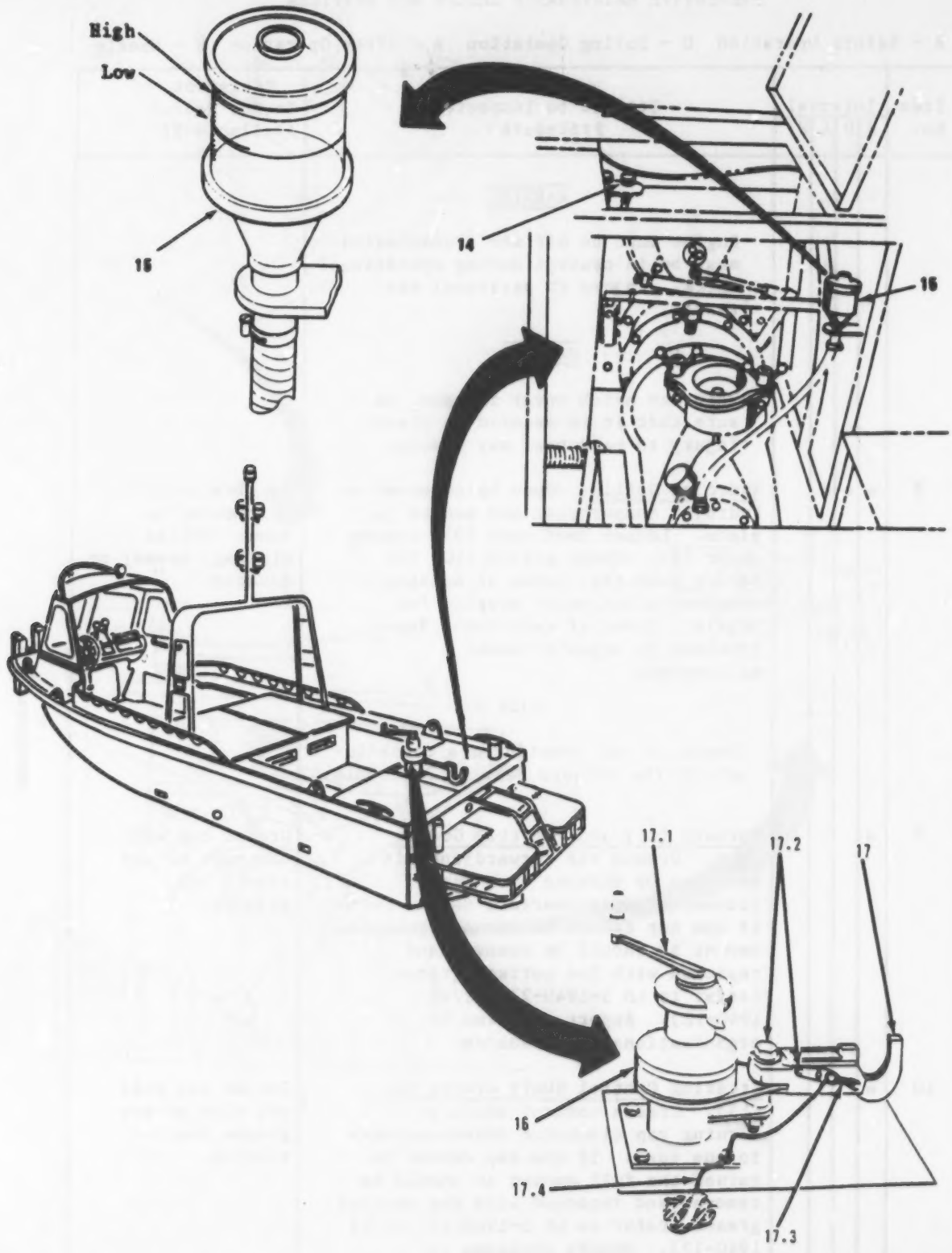
Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
4	•		•		Scoop Controls (4). Operate scoop control levers all the way forward and back. Scoop controls should operate freely but not loosely and within full range. Scoops should move with controls. Report problems to organizational maintenance.	Scoop control levers do not operate. Scoops do not move.
5	•		•		Transmission (5). Operate transmission levers all the way forward and back. Levers should operate freely and through the full range. Report problems to organizational maintenance.	Transmission control levers do not operate.
6	•				Engine Throttle Controls (6). Operate engine throttle controls all the way forward and back. Levers should operate freely and within full range. Report problems to organizational maintenance.	Engine throttle control levers do not operate, are hard to operate, or do not operate within full range. Levers damged or broken.
7	•		•		Steering Wheel (7). Turn steering wheel to full port and full starboard. Verify that scoops tilt as wheel is turned. Steering wheel should turn freely through the full range. Report problems to organizational maintenance.	Steering wheel won't turn or is hard to turn. Scoops do not tilt.


13
10
12
8
11
9

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

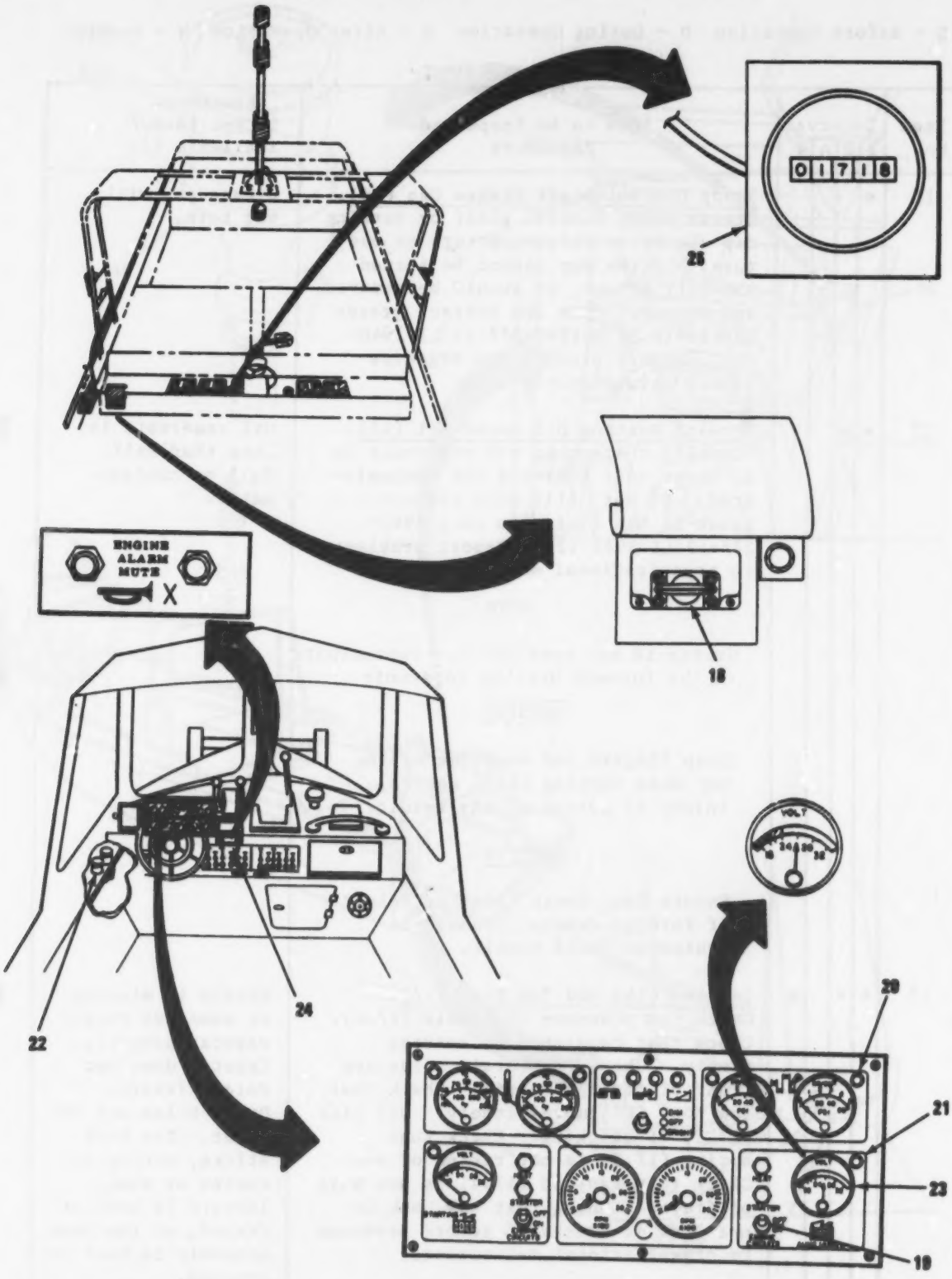
Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					WARNING Engine must be off and transmission must be in neutral during operational check. Injury to personnel may result. **WARNING** When any hatch cover is open, be sure that it is secured in place. Injury to personnel may result.	
8	•	•	•		Hydrojet Grille. Open hatch cover on hydrojet compartment and secure in place. Loosen hand nuts (8), remove cover (9). Check grille (10) for secure mounting, loose or damaged components and water passage for debris. Clean if required. Report problems to organizational maintenance. NOTE Grease is not considered a contaminate in the forward bearing reservoir.	Any debris cannot be removed by hand. Grille missing, loose, or damaged.
9	•				Forward (11) and Aft (12) Grease Caps. Grease the forward and aft bearings by turning each cap clockwise three-quarters to one turn. If the cap cannot be turned the full amount it should be removed and repacked with the correct grease (refer to LO 5-1940-277-12/LI 1940-12). Report problems to organizational maintenance.	Grease cap will not turn or any grease cap missing.
10	•				Steering Control Shaft Grease Cap (13). Grease control shaft by turning cap clockwise three-quarters to one turn. If the cap cannot be turned the full amount it should be removed and repacked with the correct grease (refer to LO 5-1940-277-12/LI 1940-12). Report problems to organizational maintenance.	Grease cap will not turn or any grease cap missing.


High
Low
15
14
15
17.1
17.2
17
16
17.4
17.3

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
11	•				Scoop Control Shaft Grease Cap (14). Grease scoop control shaft by turning cap clockwise three-quarters to one turn. If the cap cannot be turned the full amount, it should be removed and repacked with the correct grease (refer to LO 5-1940-277-12/LI 1940-12). Report problems to organizational maintenance.	Grease cap will not turn.
12	•	•			Forward Bearing Oil Reservoir (15). Visually check that oil reservoir is at least half full and not contaminated. If not, fill with correct grade of oil (refer to LO 5-1940-277-12/LI 1940-12). Report problems to organizational maintenance. NOTE Grease is not considered a contaminate in the forward bearing reservoir. WARNING Keep fingers and head out of the way when closing hatch covers. Injury to personnel may result. CAUTION Ensure four drain holes are clear of foreign debris. Damage to equipment could result.	Oil reservoir is less than half full or contaminated.
13	•	•		•	Capstan (16) and Tow Hook (17). Check for presence of handle (17.1). Check that capstan (16) rotates freely. Check that drain holes are clear of foreign debris. Check that tow hook (17) moves freely. Oil pins (17.2) if sticking. Check that spring (17.3) is not rusted or weak. Check that lanyard (17.4) is not worn or frayed. Check that tow hook is not bent or cracked. Report problems to organizational maintenance.	Handle is missing or does not rotate capstan properly. Capstan does not rotate freely. Drain holes are not clear. Tow hook sticks, spring is rusted or weak, lanyard is worn or frayed, or tow hook assembly is bent or cracked.


0 1 7 1 8
25
ENGINE
ALARM
MUTE
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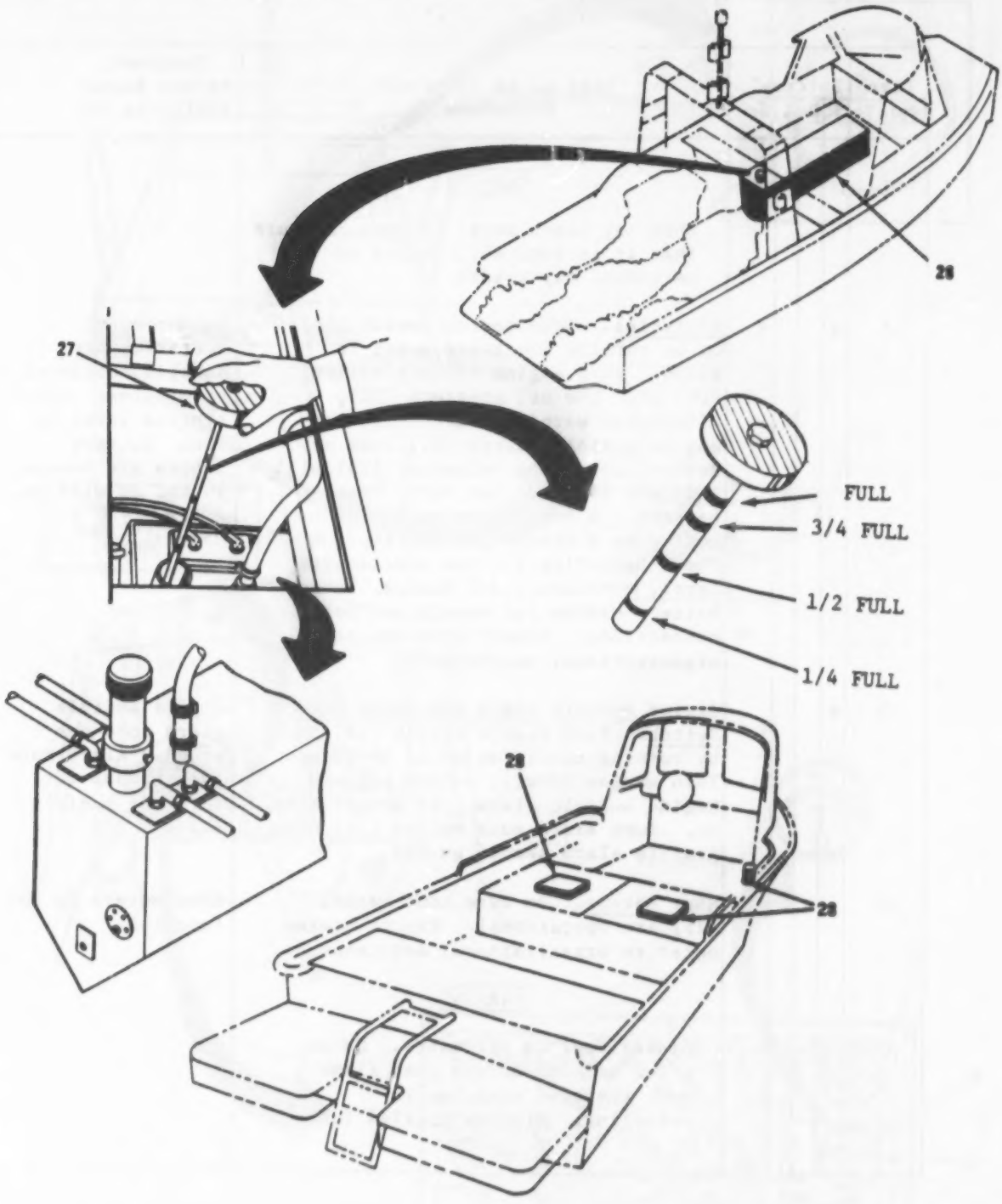
PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					WARNING When any hatch cover is open, be sure that it is secured. Injury to personnel may result.	
14	•			•	Batteries. Turn master switch (18) ON by turning clockwise until it stops. Turn engine circuit switch (19) ON. Low oil pressure (20), alternator warning lights (21) and engine audible alarms (22) come on. Battery condition voltmeter (23) will indicate 25.4 vdc for fully charged battery. A reading below 24 vdc indicates a discharged battery. Check batteries for low electrolyte level, corrosion, and damage. Check battery cables for damage and loose connections. Report problems to organizational maintenance.	One or more batteries are damaged, corroded, or missing. Electrolyte level is low. Battery cables are damaged, loose, or missing.
15	•				Engine Audible Alarm and Alarm Mute Switch. Turn master switch (18) ON by turning clockwise until it stops. Turn engine circuit switch (19) ON. Engine audible alarm (22) should come on. Turn alarm mute switch (24) OFF. Audible alarm should go off.	Engine audible alarm does not sound. Alarm mute switch does not turn off audible alarm.
16		•			Hour Meters. Be sure hour meters (25) are operational. Report broken meter to organizational maintenance.	Hour meters do not function.
					WARNING Diesel fuel is flammable. Do not allow smoking or any open flame near the boat when you're refueling. Wipe up spilled fuel.	


26
27
FULL
3/4 FULL
1/2 FULL
1/4 FULL
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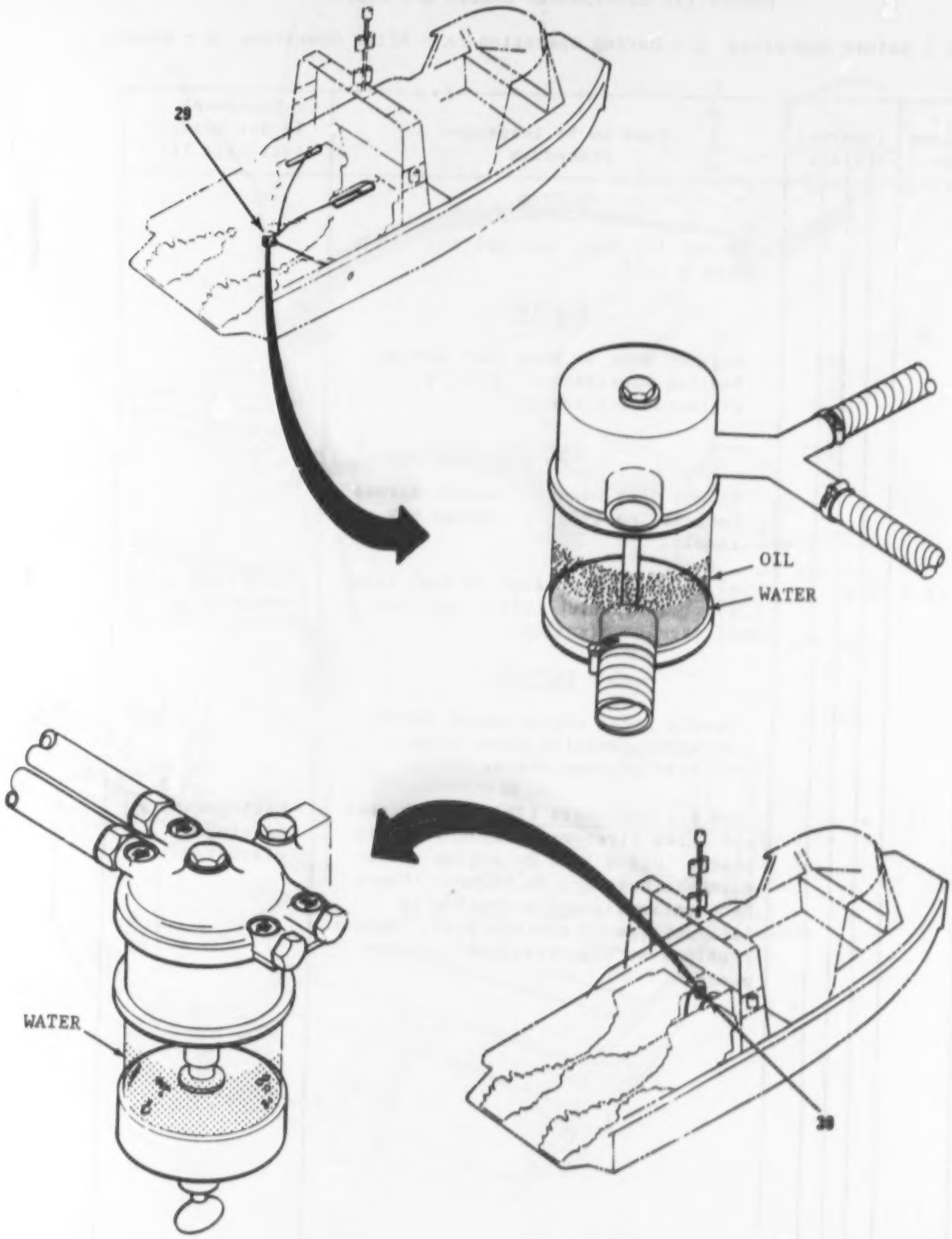
28

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

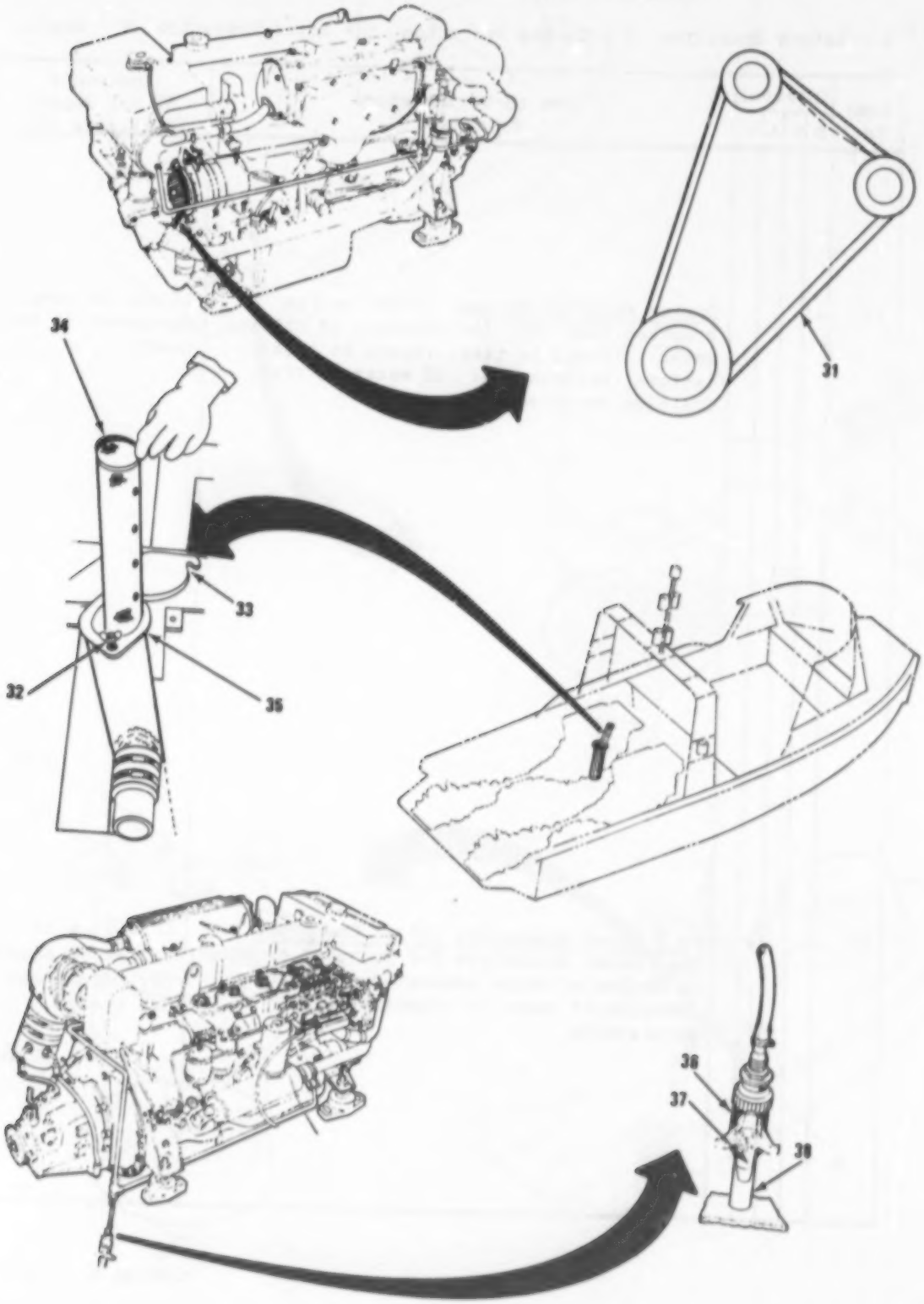
Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					CAUTION Do not let fuel tank get any lower than ¼ full. WARNING Engines must be shut down during fueling operations. Fire or explosion may result. CAUTION Do not drag hose and nozzle across fuel sediment bowl. Damage may result.	
16.1	•	•			Fuel Tank. Check level in fuel tank (26) with dipstick (27). Add fuel to full mark on dipstick. CAUTION Gently lower engine hatch covers to avoid damaging glass tubes in fire extinguishers.	Fuel tank is empty.
17	•				Fire Extinguishers (28). Check that all three fire extinguishers are in place. Glass tube on engine extinguishers must not be broken. Check hand extinguishers according to instructions on extinguisher. Report problems to organizational maintenance.	Extinguishers missing or discharged.


29
OIL
WATER
WATER
30

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
18	•				Engine Breather System. Check engine breather trap (29) for presence of oil and water. If oil in trap, report to organizational maintenance. If water in trap, drain as required.	If oil in trap, equipment is not ready.
19	•		•		Fuel Water Separators (30). Check the fuel water separators for presence of water in bottom of water separator. Report presence of water to organizational maintenance.	If H_2O is in bottom of separator, equipment is not ready.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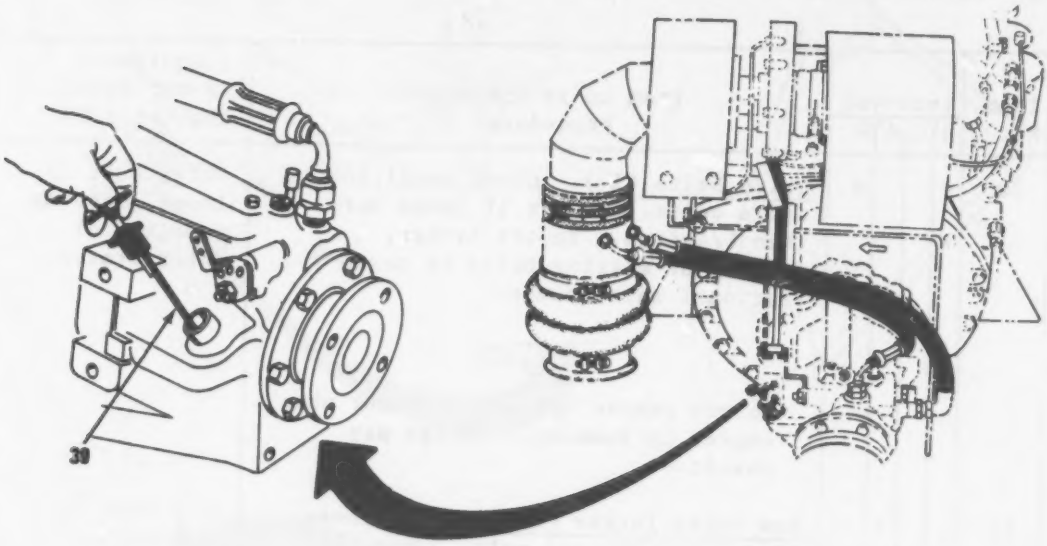
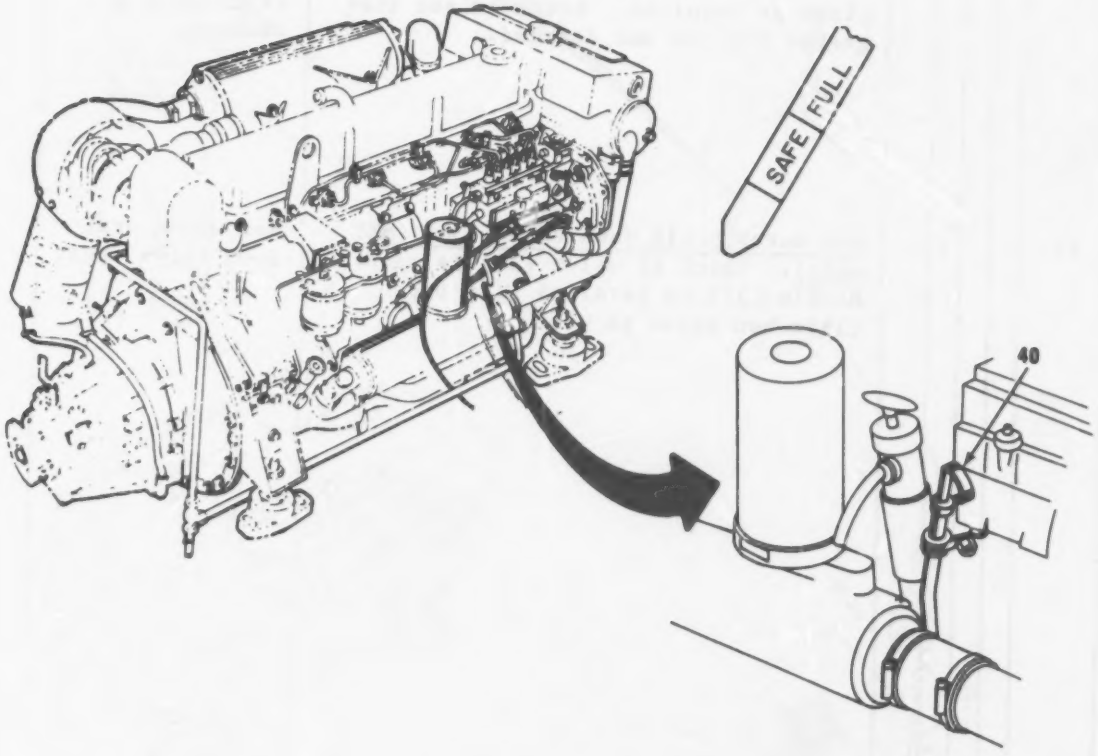
PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
20	•			•	Drive Belts (31). Check condition of drive belts. Report if loose more than 1/4-inch. Report broken, frayed, or missing belts to organizational maintenance. CAUTION Do not remove cap and strainer when engine is running. Damage may result.	Drive belt is loose, missing, damaged, or deteriorated.
21			•		Raw Water Intake (MK1 only). Loosen wing nuts (32) and swing cover (33) aside. Pull out strainer (34). Clean as required. Check to see that gasket (35) is not damaged.	Strainer is missing or damaged. Gasket is missing or damaged.
22			•		Raw Water Drain Down Valve (36) (MK1 only). Check if valve (36) is open. Handle (37) is parallel with pipe (38) when valve is open.	Raw water drain down valve open.

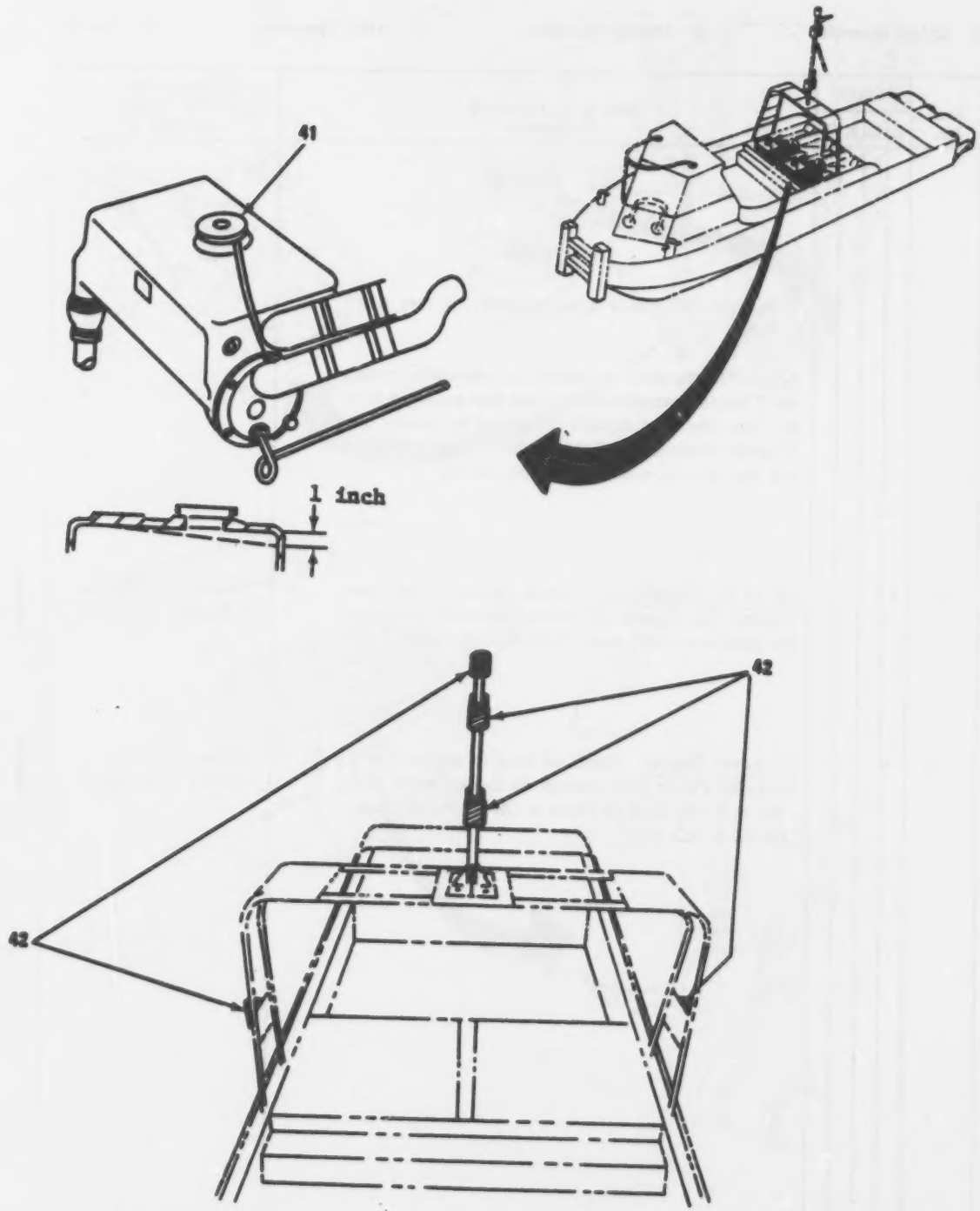

39


SAFE
FULL
40

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

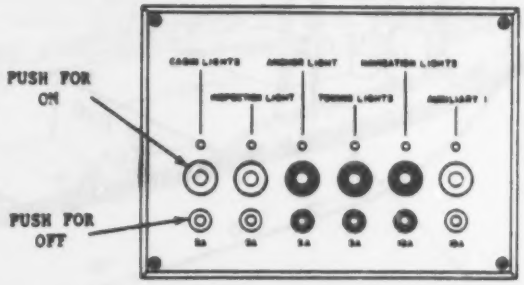
Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					CAUTION Remove and replace dipsticks slowly, so they won't bend. Note: The transmission dipstick is released by turning the T-handle counterclockwise and then pulling it from the filler tube. The dipstick is replaced by turning the T-handle clockwise until the dipstick is firmly in place and does not move under moderate pulling.	
23	•				Oil Level, Transmission. Check oil level of the transmission. The dipstick (39) should show oil at or above the mark on a cold check. Add oil as required.	Transmission dipstick is missing.
24	•				Oil Level, Engine. Check oil level of engine. The dipstick (40) should show enough oil for operation. Oil level at SAFE mark or above is OK on a cold check. Add oil to full mark.	Engine oil level dipstick is missing.

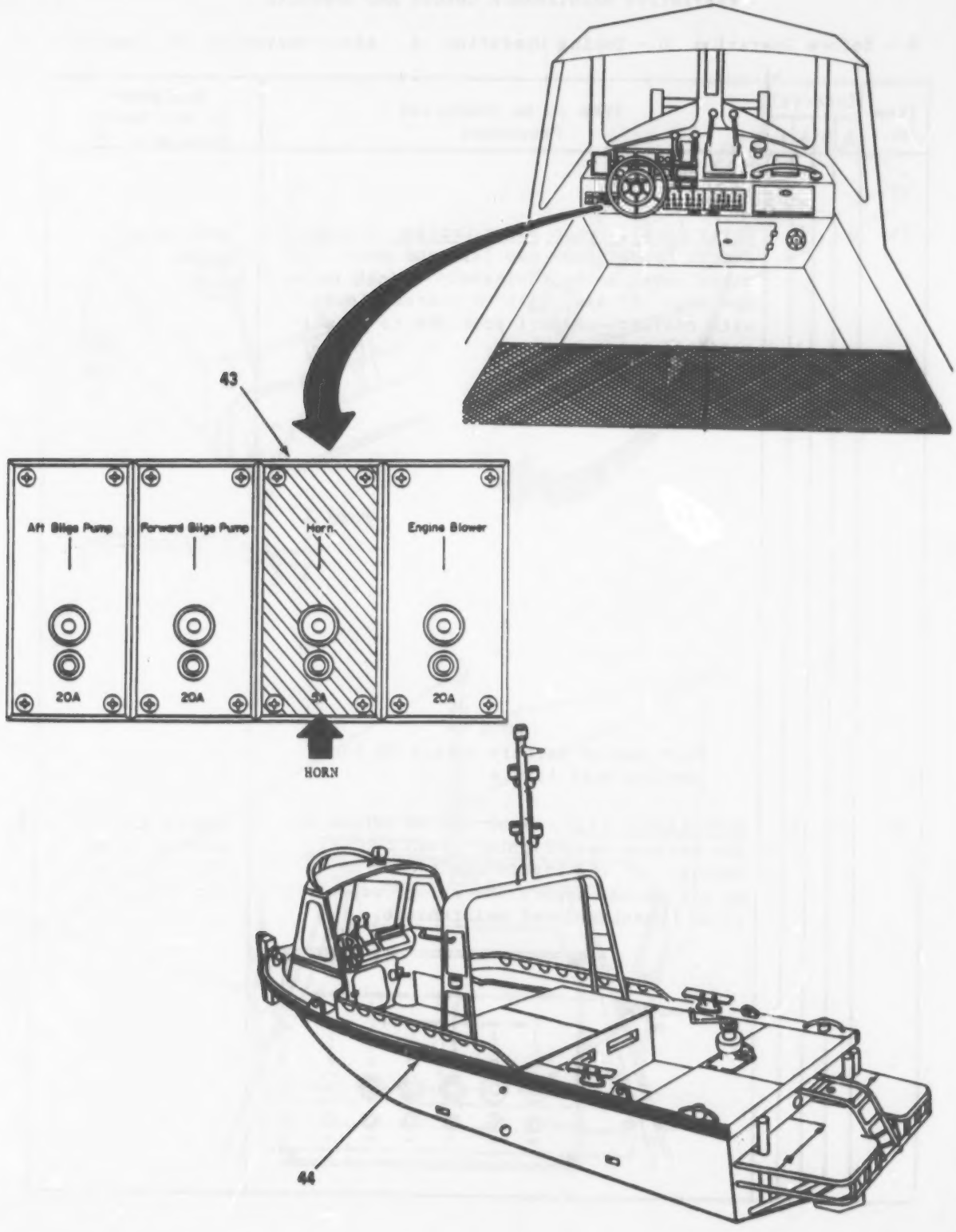

41
1 inch
42
42

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
25	•				Water Level, Fresh Water Cooling System(s). Remove header tank cap (41) and check that water level is approximately 1 inch below opening. If low, fill to correct level with coolant. Report problems to organizational maintenance.	Water level is low.
					NOTE Turn master battery switch ON for testing mast lights.	
26	•		•		Mast Lights (42). Push the ON button for the various mast lights. Push the OFF button. If the lights don't come on or go off or the colors are wrong, report it to organizational maintenance.	Lights don't come on or go off. Colors are wrong.

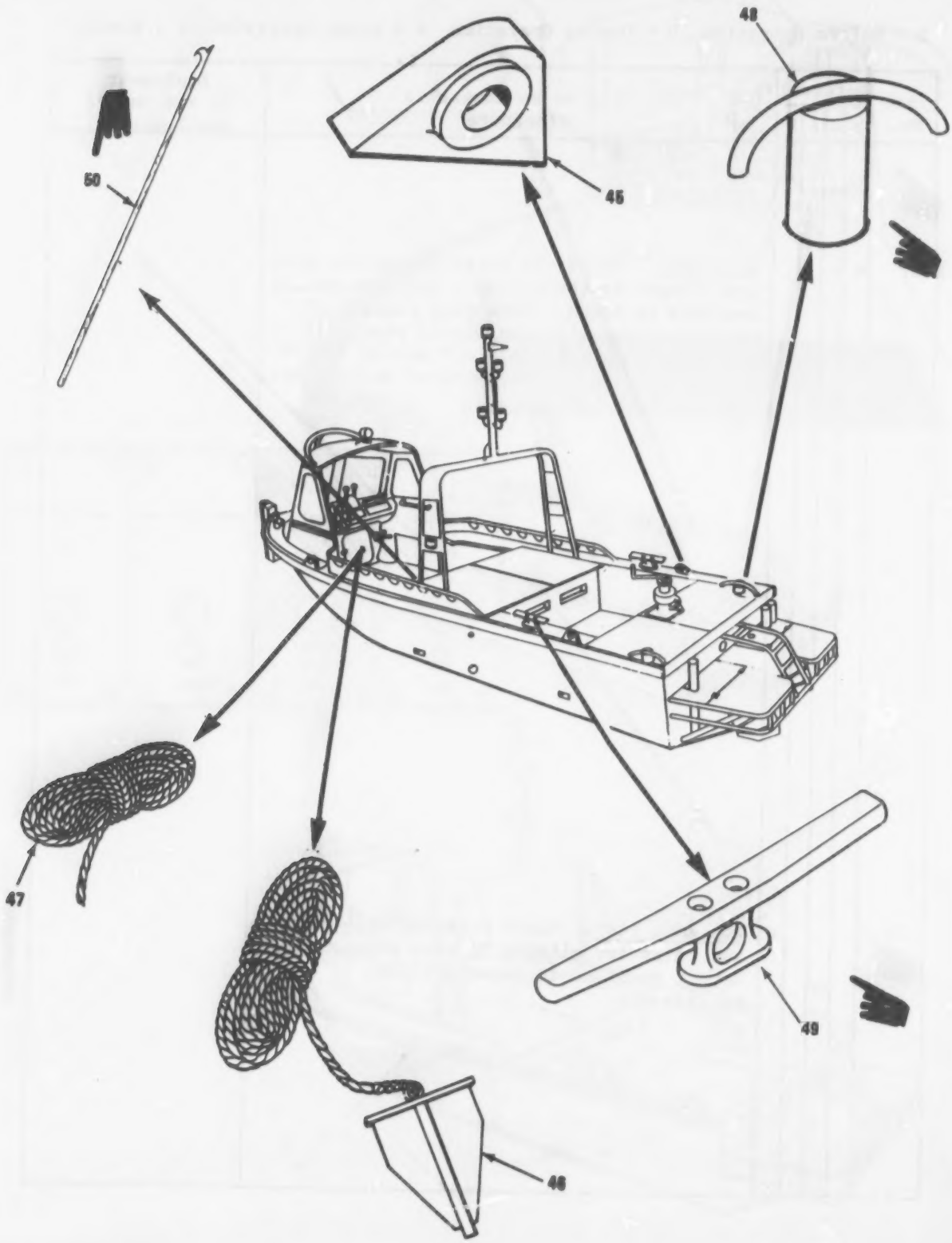



43
Aft Bilge Pump
Forward Bilge Pump
Horn
Engine Blower
20A
20A
5A
20A
HORN
44

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
27	•	•			Horn (43). Press the large button and keep your finger on the button. The horn should continue to sound. Take your finger off the button and the horn should stop. If horn does not stop, turn off master switch and report it to organizational maintenance.	
28				•	Rub Rail (44). Check port and starboard rub rails for missing or torn sections. Report problems to organizational maintenance.	


48
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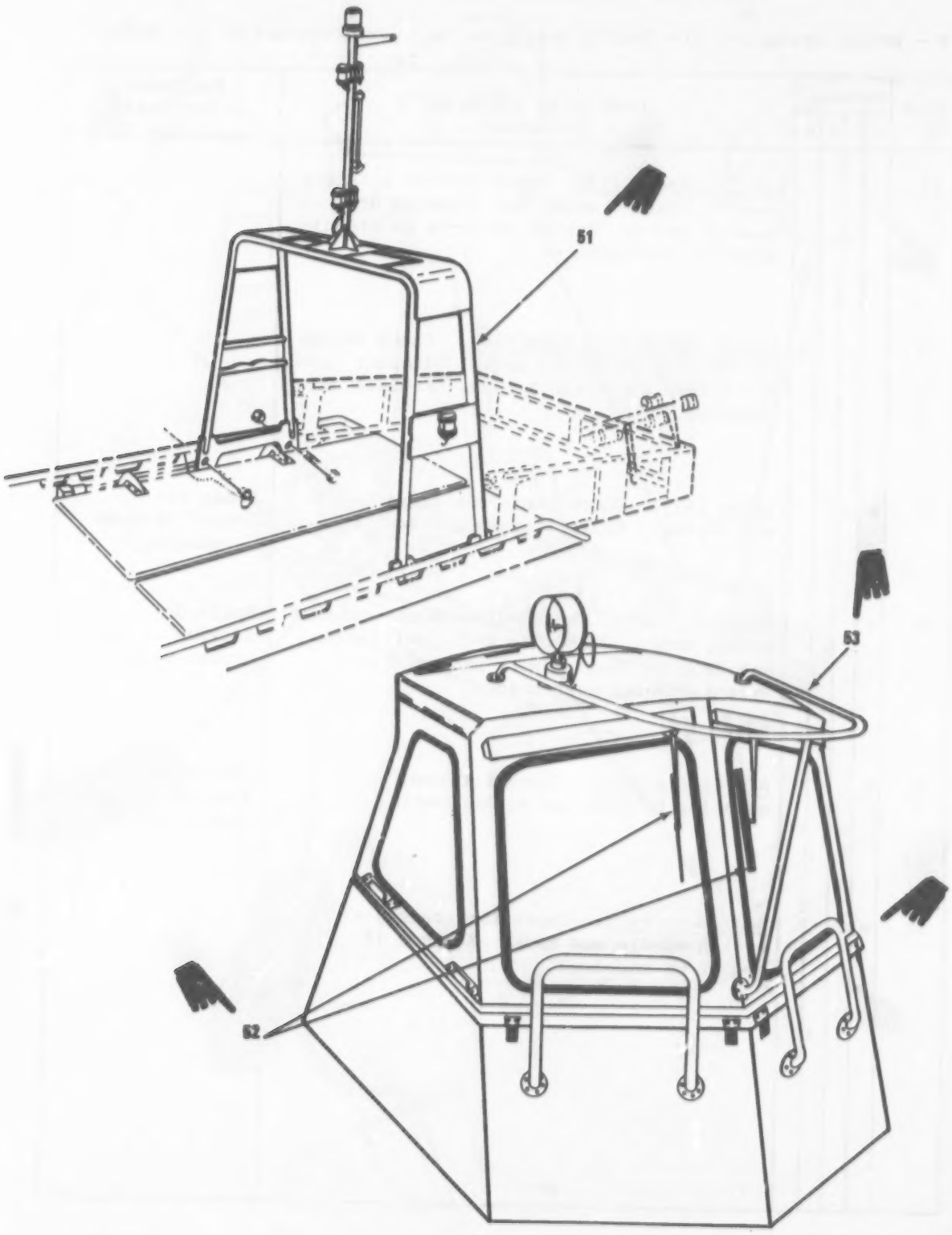
46

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
29				•	Lifting Eyes (45). Check lifting eyes for torn or cracked welds and deformed or missing parts. Report problems to organizational maintenance.	
30				•	Anchor and Anchor Line (46). Check anchor for missing or broken parts. Inspect line for frayed spots and breaks. Replace as required.	
31	•	•			Lines (47). Check lines for frayed spots and breaks. Replace lines as required.	Lines are frayed, broken or missing.
32	•				Bollards (48). Check bollards for cracked welds, sharp edges that could cut lines, and deformation. Report problems to organizational maintenance.	Bollards missing or have broken welds.
33	•				Aft Cleats (49). Check for secure mounting to deck and broken parts.	Aft cleats missing or have broken welds.
34	•				Boat Hook (50). Check for cracked or broken handle and hook. Replace if broken or missing.	


51
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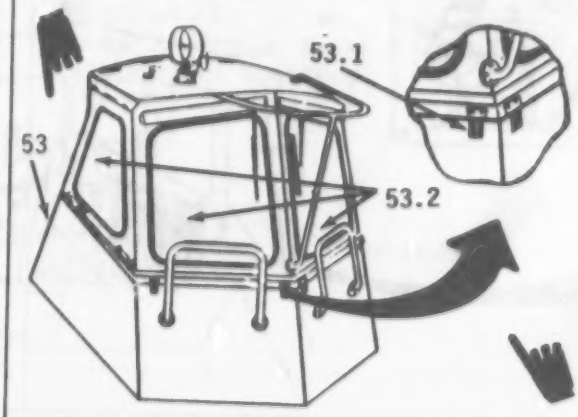
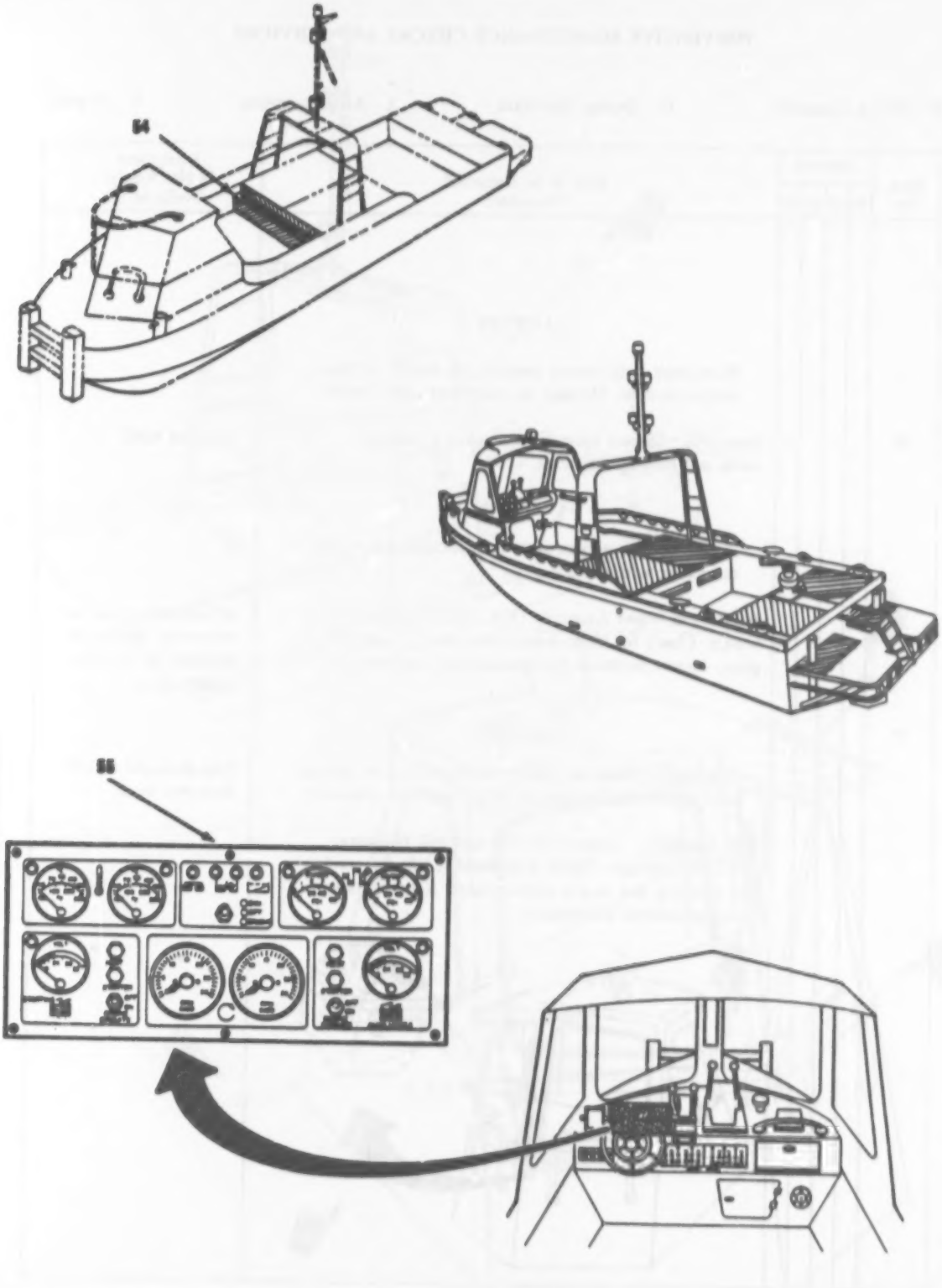
52

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

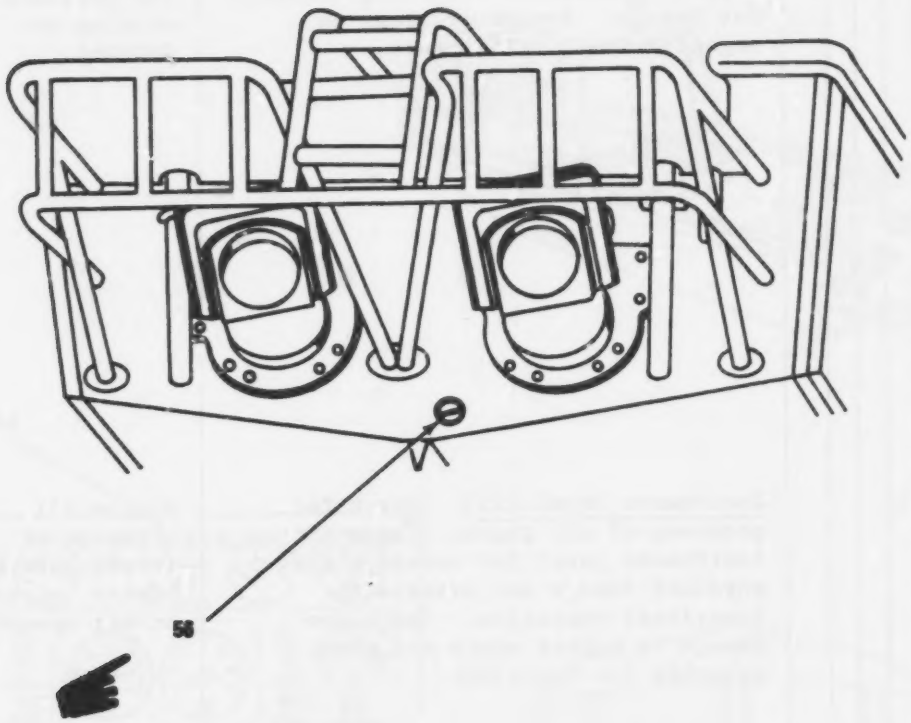
Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					CAUTION When mast is in stowed position, do not sit or place weight on mast. Damage to equipment could result.	
35				•	Mast (51). Inspect mast for damage, i.e., broken welds and missing hardware.	Mast damaged.
					CAUTION Do not operate wipers more than necessary to avoid scratching windshield panel.	
36	•				Windshield Wiper Assembly (52). Operate windshield wipers. Check for blade deterioration and contact with glass. Report problems to organizational maintenence.	Windshield wipers not operating. Blades deterioated or not contacting glass.
37				•	**CAUTION** Windshield panels are plastic and should not be cleaned with abrasive or chemical cleaning compound or solution.	Cab damaged or hull fasteners loose.
					Cab Assembly. Inspect cab (53) and hull fastenings (53.1) for damage. Check windshield (53.2) for cracks and scouring that would impair vision. Report problems to organizational maintenance.	
						


54
55

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
					CAUTION Gently lower engine hatch compartment cover to avoid damaging glass tubes in fire extinguisher.	
38				•	Hatches (54). Inspect all hatches and hinges for fit and damage. Check support braces and attaching hardware for damage. Report problems to organizational maintenance.	Hatches not functional. Braces and hardware missing or damaged.
39	•				Instrument Panel (55). Check for presence of all gages. Inspect instrument panel for broken glass, physical damage and observe for functional operation. Check for damage to rubber boots and check switches for function.	Engine oil pressure or temperature gage broken, missing, or not operating.


56

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before Operation D - During Operation A - After Operation W - Weekly

Item No.	Interval B	D	A	W	Item to be Inspected Procedure	Equipment Is Not Ready/ Available If:
40	•		•		Bilge Drain Plug (56). Before launch install bilge drain plug (56) and tighten securely. Loosen bilge drain plug (56) and allow accumulated water to drain out after boat and cradle are on transporter. Inspect the plug itself for servicability of threads, fit, etc.	Equipment not ready if plug is missing or damaged and if cradle NSN 2090-01-106-9789 is not ready/available in accordance with TM 5-2090-202-12&P
41			•		Check all motor mounts, insure nuts are tight.	Equipment not ready if motor mount nuts are not tight.

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Section III. OPERATION UNDER USUAL CONDITIONS

2-13. STARTING ENGINES (NORMAL)

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Do not start or operate engines with MK1 boat out of water. Severe engine damage will result.

For exception during organizational or higher maintenance actions, refer to TM 5-1940-277-20.

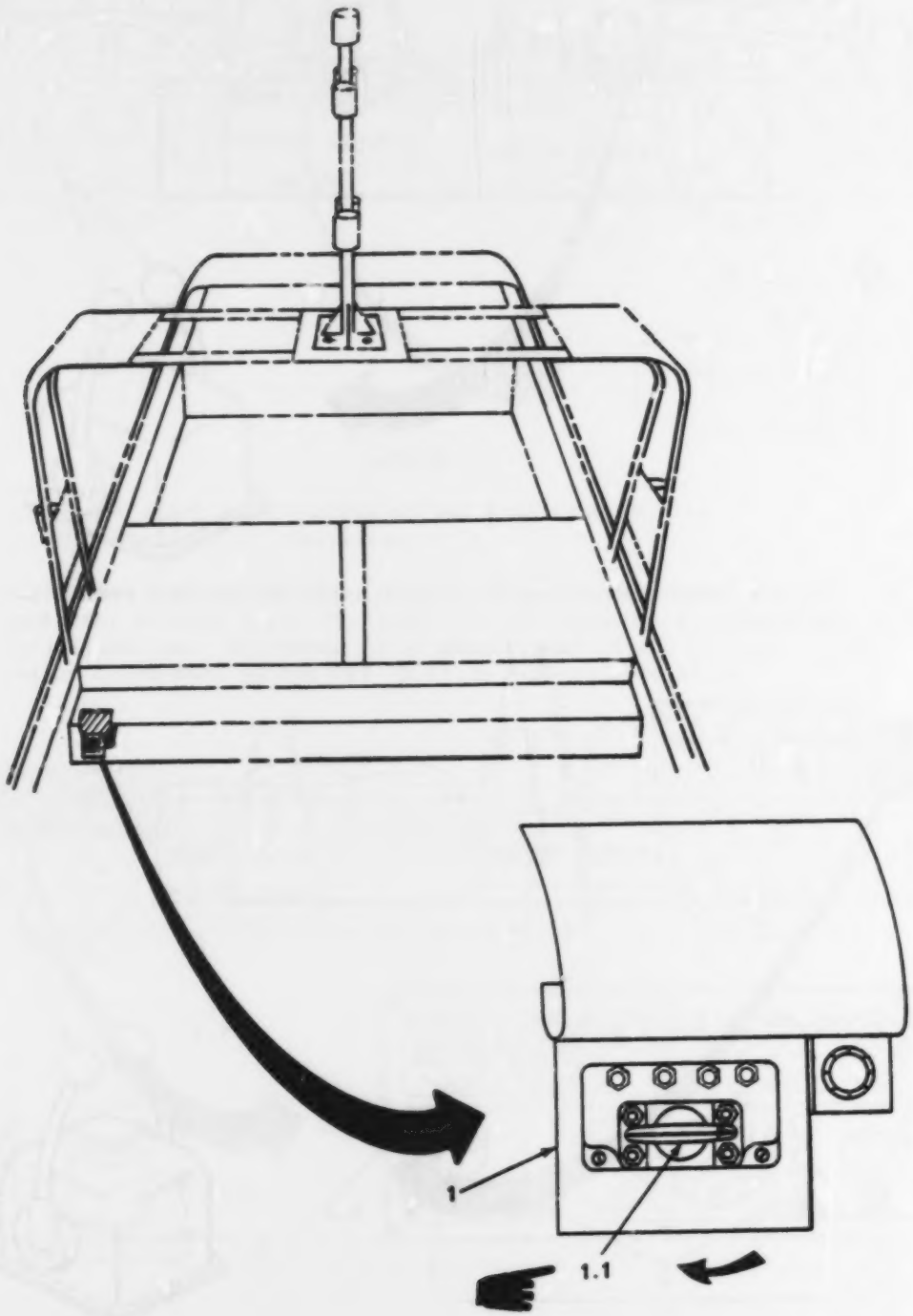
CAUTION

Do not use the electric bilge pumps for longer than 1 minute unless the engines are running. Without the engines running, the bilge pumps will soon run down the batteries.

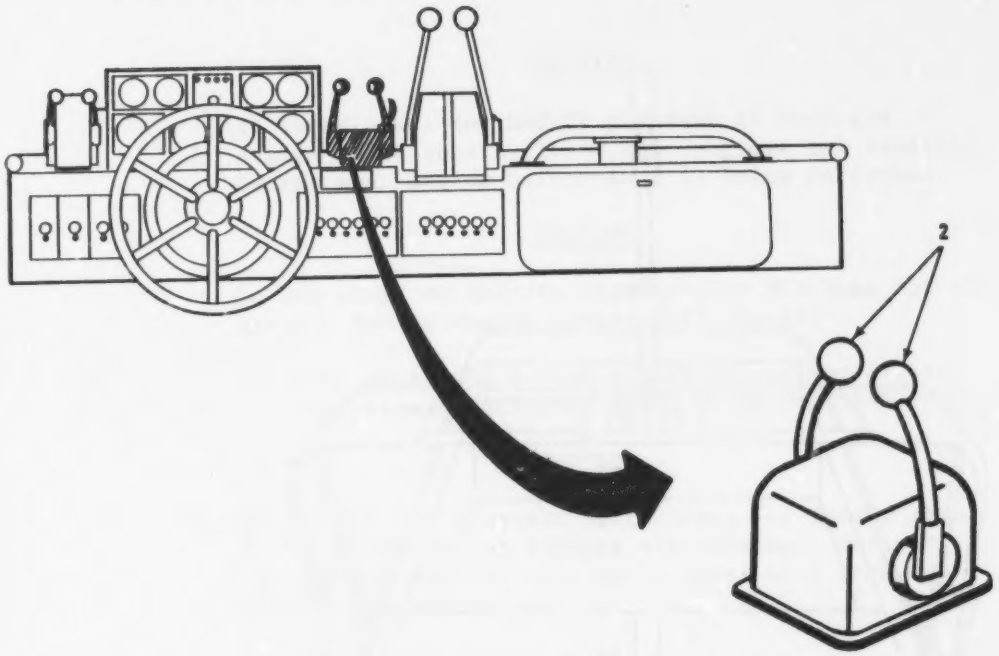
NOTE

Check for water in the engine compartment. If the water is up to or above engine mounts, use the hand operated bilge pump to lower the water to below the engine mounts before starting the engine.

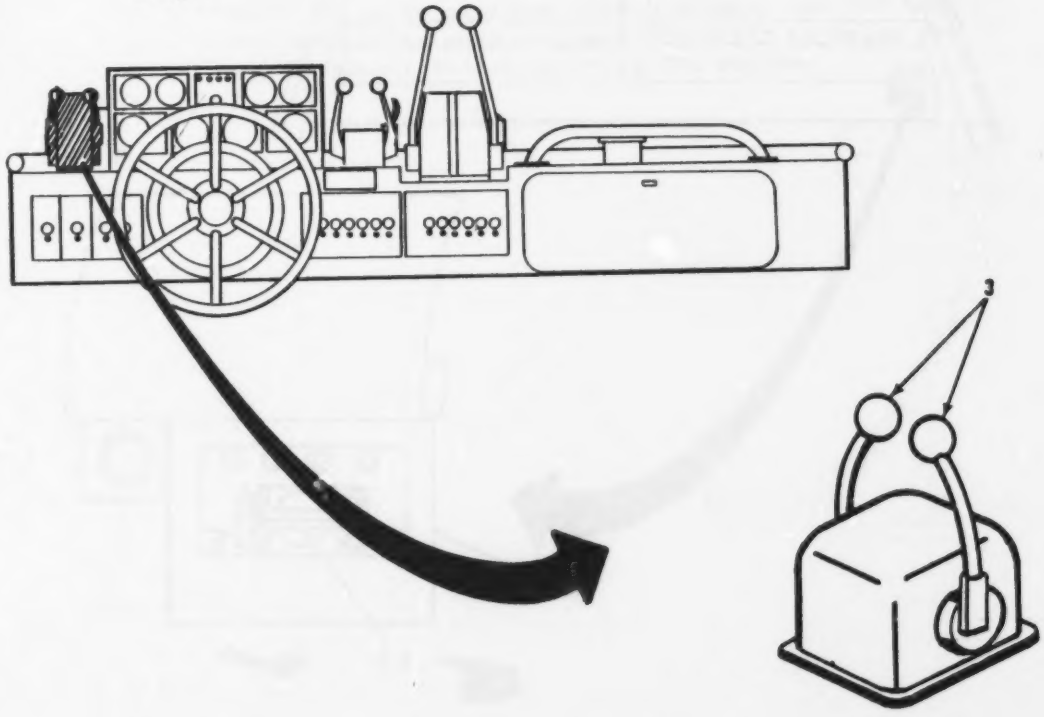
a. Turn master battery switch (1) ON by turning handle (1.1) clockwise until it stops.



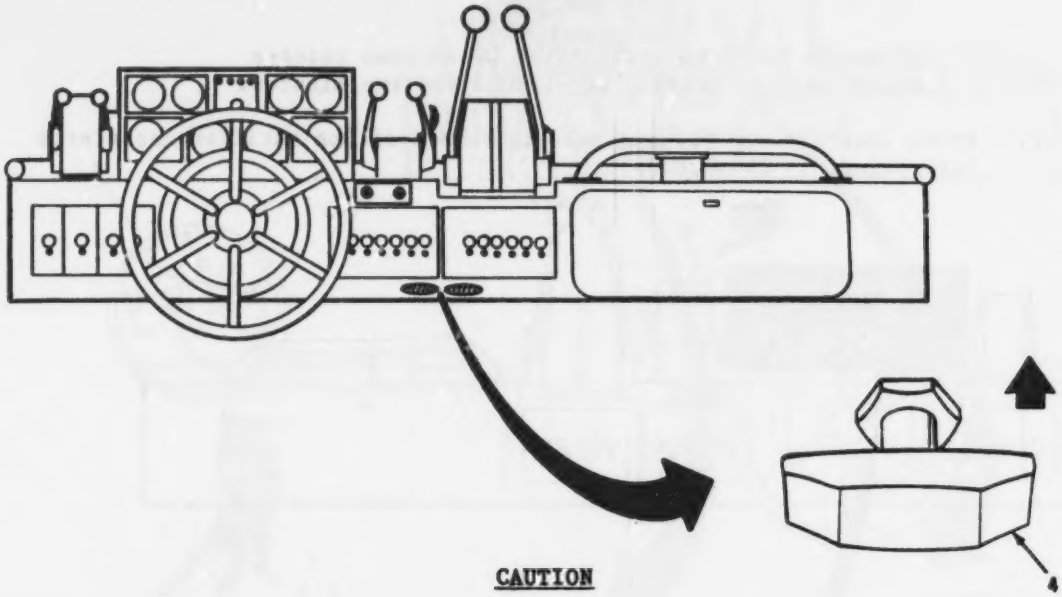
b. Set the throttle controls (2) for half speed (approximately in the middle).



c. Set the transmission control levers (3) in neutral position (center stop).



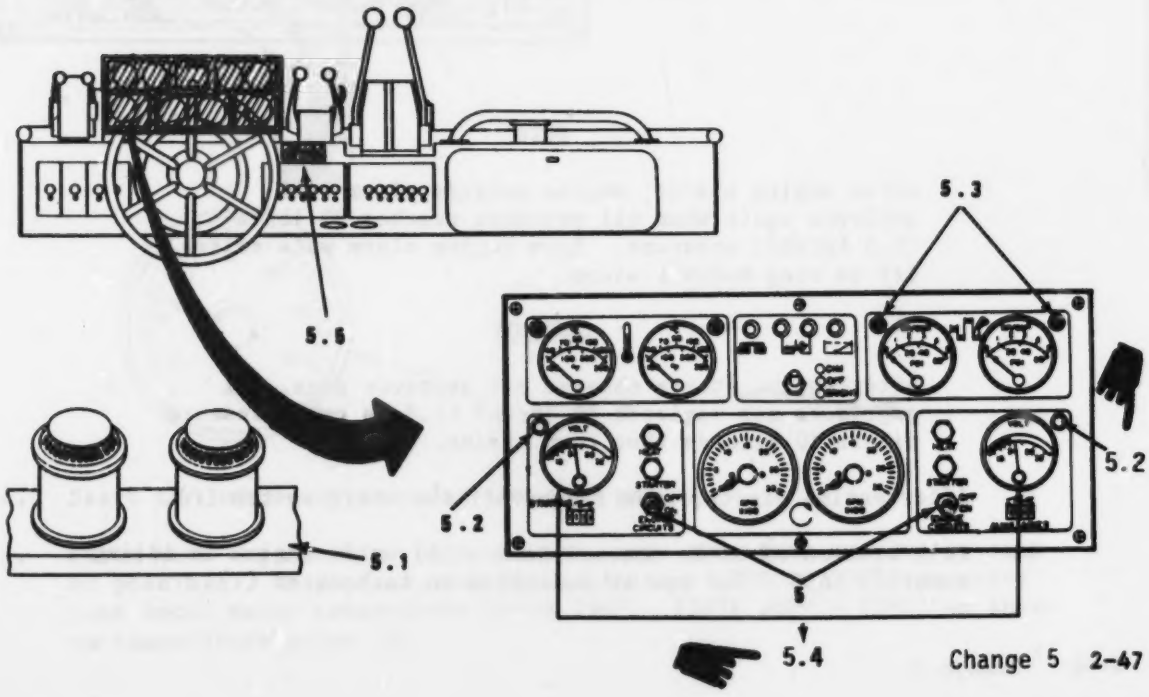
d. Push engine stop controls (4) all the way in.



CAUTION

Do not start both engines at the same time as this will run down the batteries.

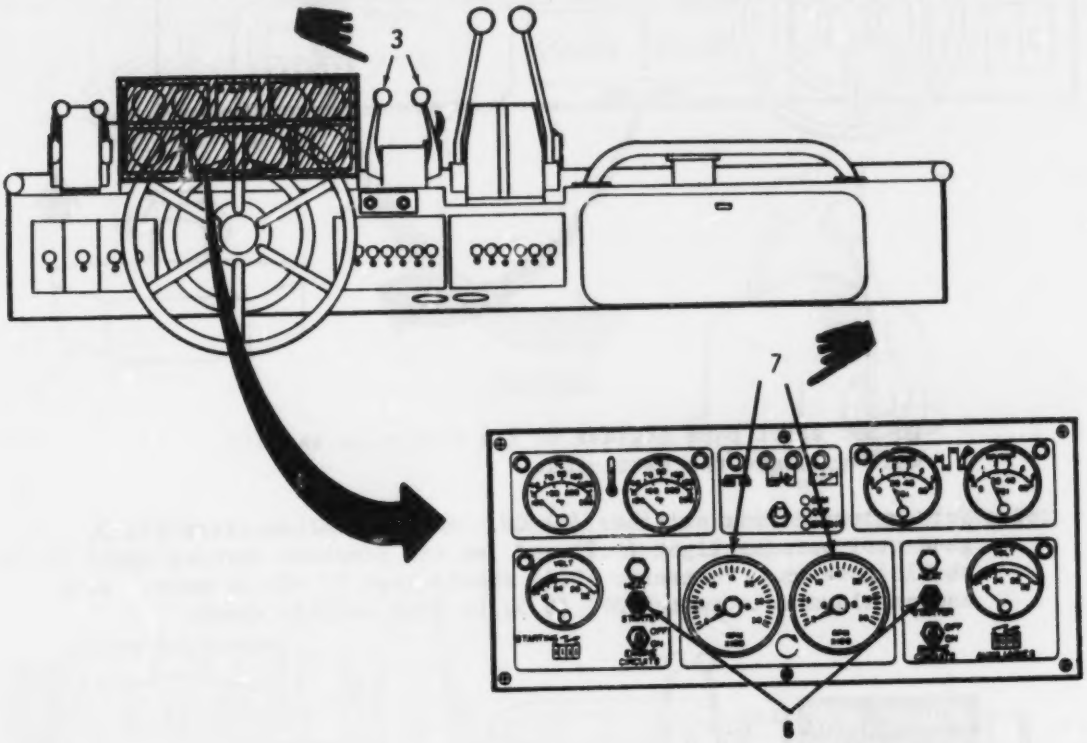
e. Set engine circuit switches (5) ON. Engine audible alarm (5.1), generator warning light (5.2) and low oil pressure warning light (5.3) should come on. Voltmeter (5.4) should read 25 vdc or more. Turn engine alarm mute switch OFF (5.5) to stop audible alarm.



CAUTION

If engine fails to start after 30 seconds release switch and let starter motor cool for two minutes.

f. Press start button (6) and hold in this position until engine starts (approximately 10 seconds).



NOTE

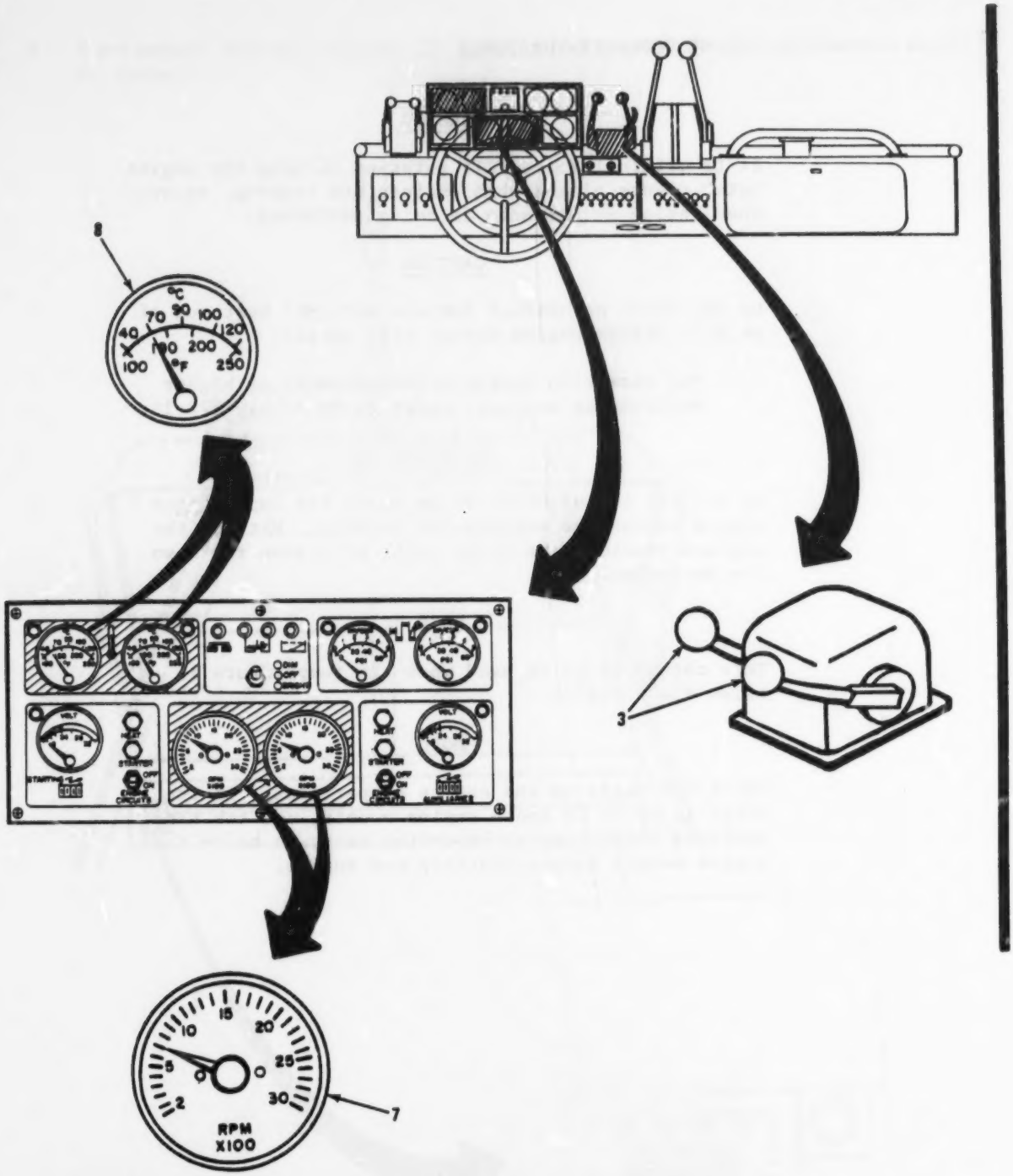
After engine starts, engine audible alarm will activate again when oil pressure reaches 20 lb/in^2 (1.5 Kp/cm^2) pressure. Turn engine alarm mute switch OFF to stop audible alarm.

CAUTION

After engine starts observe oil pressure gage. If gage does not register 20 lb/in^2 (1.5 Kp/cm^2) pressure within 10 seconds shut down engine.

g. After engine starts, take finger off the start switch (6).

h. Pull back on throttle control levers (3) until engine is idling smoothly (650 - 750 rpm as indicated on tachometer (7)).



i. Start the other engine using the same procedure.

j. After both engines have been started, move away from mooring as soon as possible. If you can, run the engines at 1800 to 2000 rpm under load until water temperature reads 140° - 158°F (60° - 70°C) as shown on temperature gages (8).

2-14. STARTING ENGINE (COLD TEMPERATURE)

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Do not start or operate engines with MK1 boat out of water. Severe engine damage will result.

For exception during organizational or higher maintenance actions, refer to TM 5-1940-277-20.

CAUTION

Do not use the electric bilge pumps for longer than 1 minute unless the engines are running. Without the engines running, the bilge pumps will soon run down the batteries.

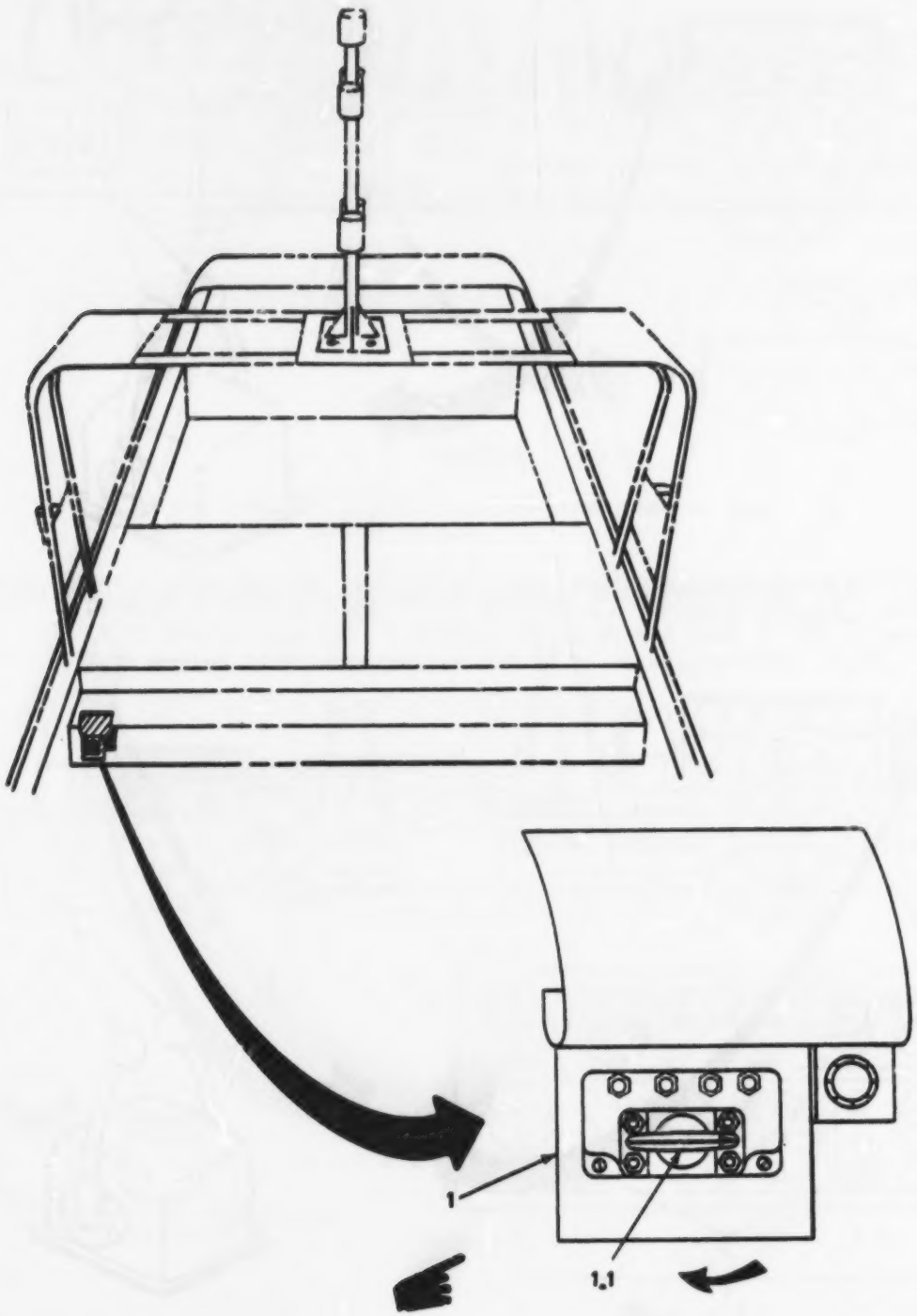
NOTE

This method is to be used when the temperature is below +50°F (10°C).

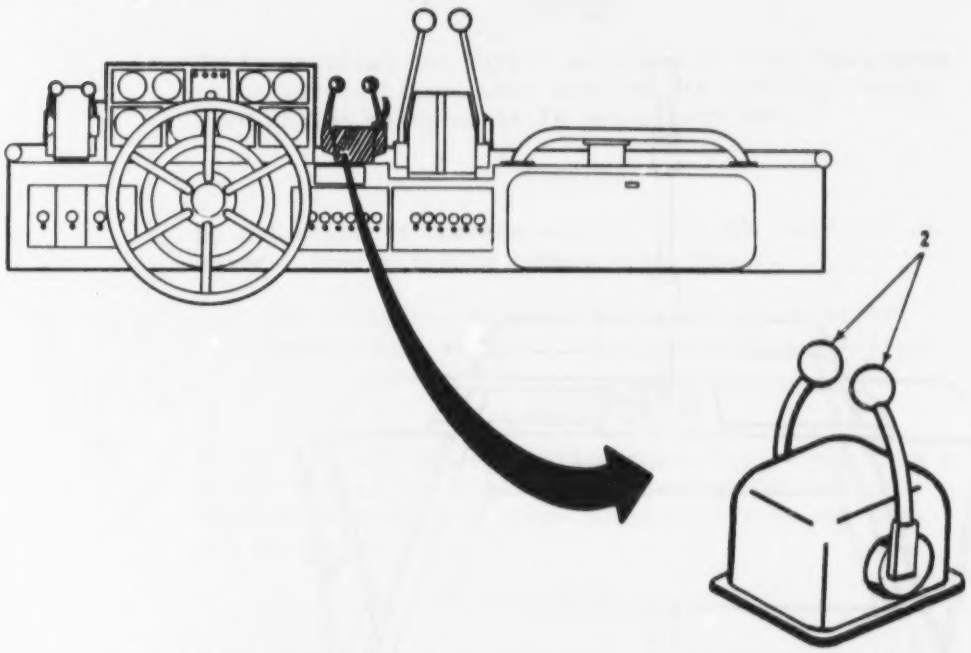
NOTE

Check for water in the engine compartment. If the water is up to or above engine mounts, use the hand operated bilge pump to lower the water to below the engine mounts before starting the engine.

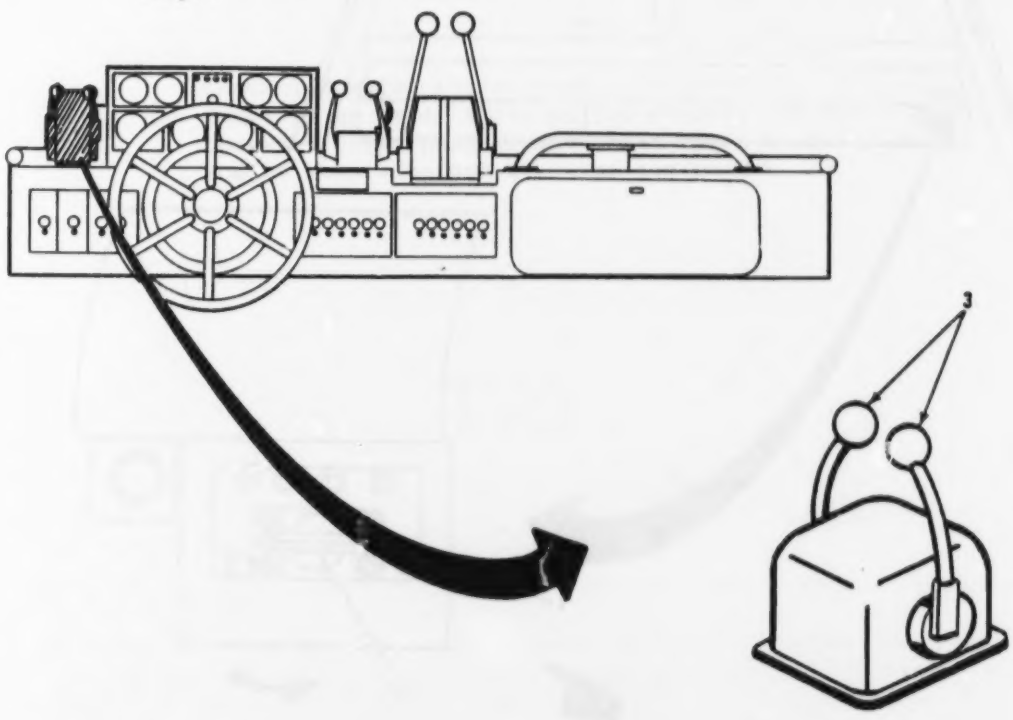
a. Turn master battery switch (1) ON by turning handle (1.1) clockwise until it stops.



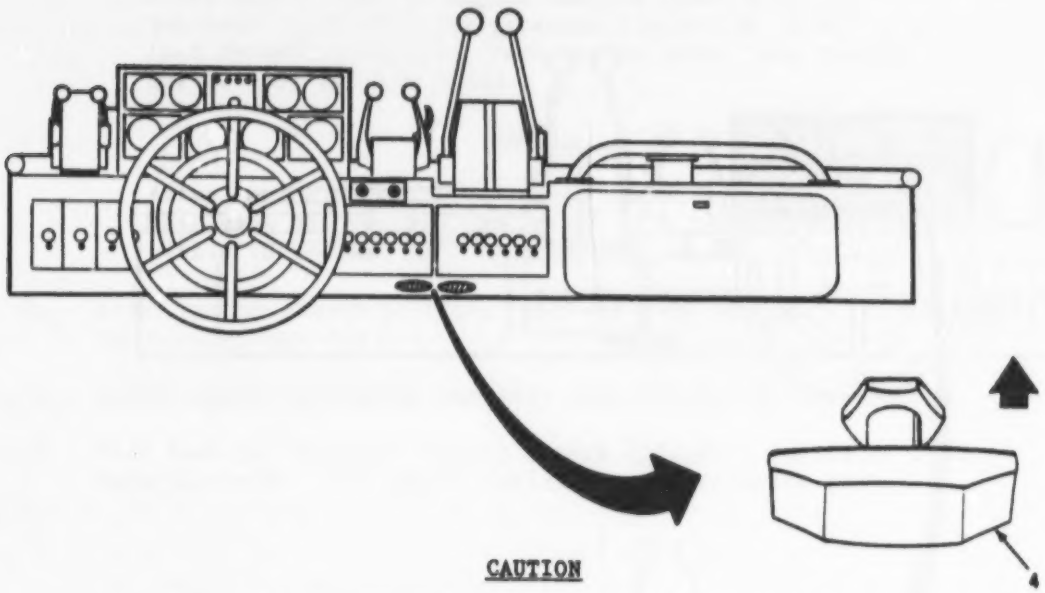
b. Set the throttle controls (2) for half speed (approximately in the middle).



c. Set the transmission control levers (3) in neutral position (center stop).



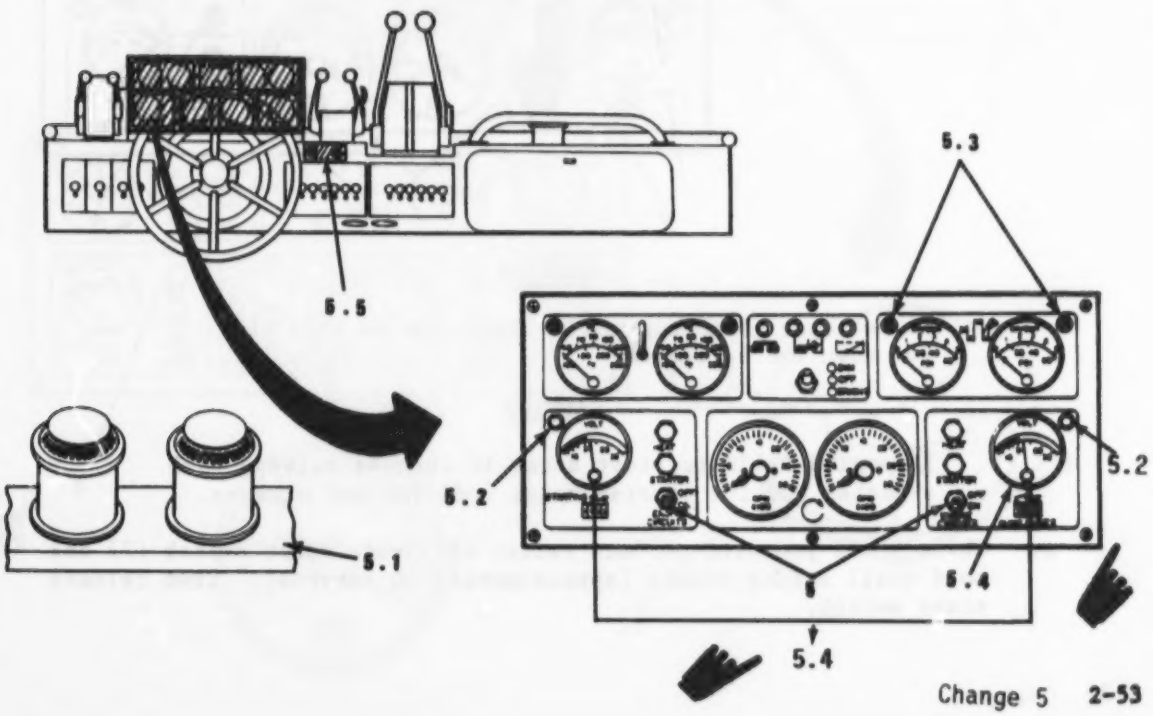
d. Push engine stop controls (4) all the way in.



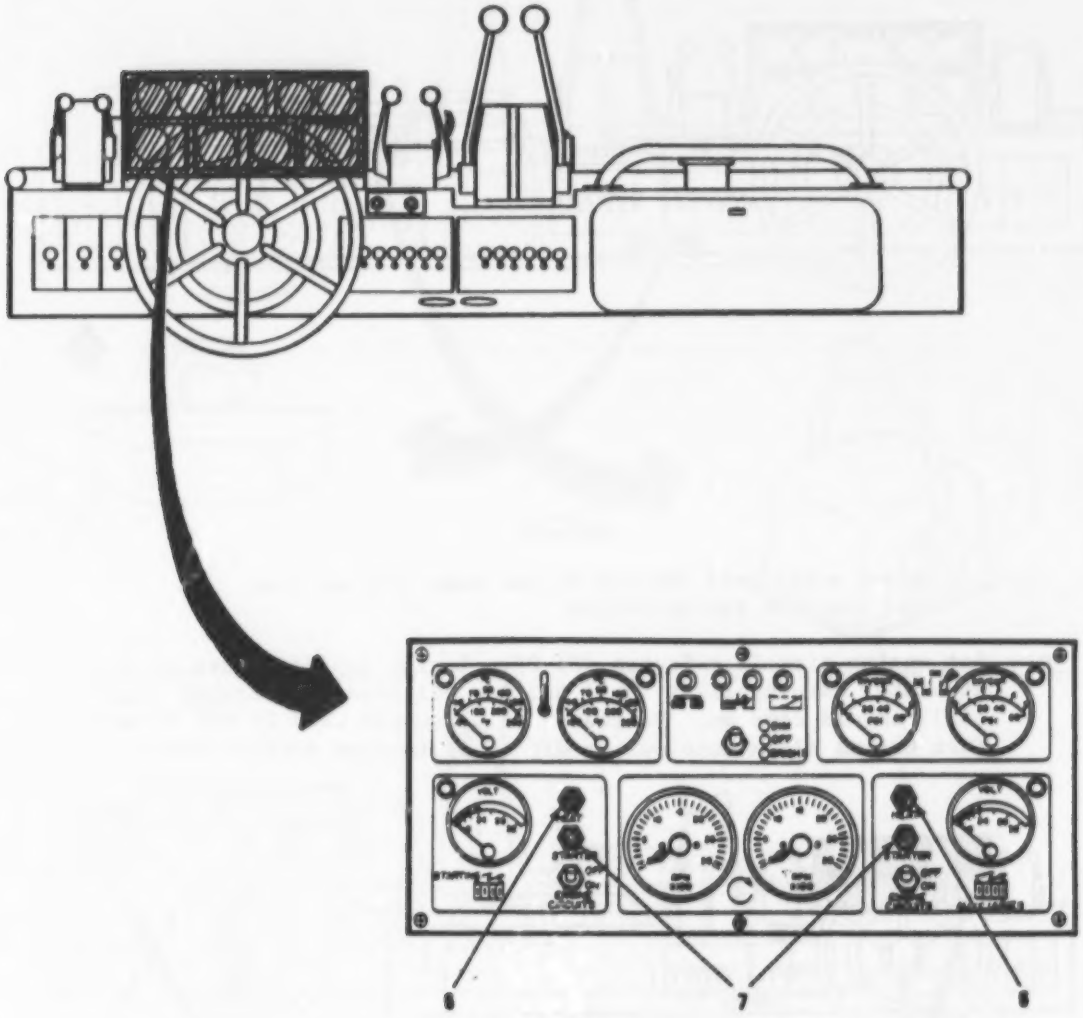
CAUTION

Do not start both engines at the same time as this will run down the batteries.

e. Set engine circuit switches (5) ON. Engine audible alarm (5.1), generator warning light (5.2) and low oil pressure warning light (5.3) should come on. Voltmeter (5.4) should read 25 vdc or more. Turn engine alarm mute switch OFF (5.5) to stop audible alarm.



f. Press heat switch (6) and hold for 20 seconds.



CAUTION

Do not start both engines at same time as this will run down the batteries.

CAUTION

If engine fails to start after 30 seconds release both switches and let starter motor cool for two minutes.

g. While still pressing on heat switch (6) press start switch (7) and hold until engine starts (approximately 10 seconds). Then release start switch.

NOTE

After engine starts, engine audible alarm will activate again when oil pressure reaches 20 lb/in^2 (1.5 Kp/cm^2) pressure. Turn engine alarm mute switch OFF to stop audible alarm.

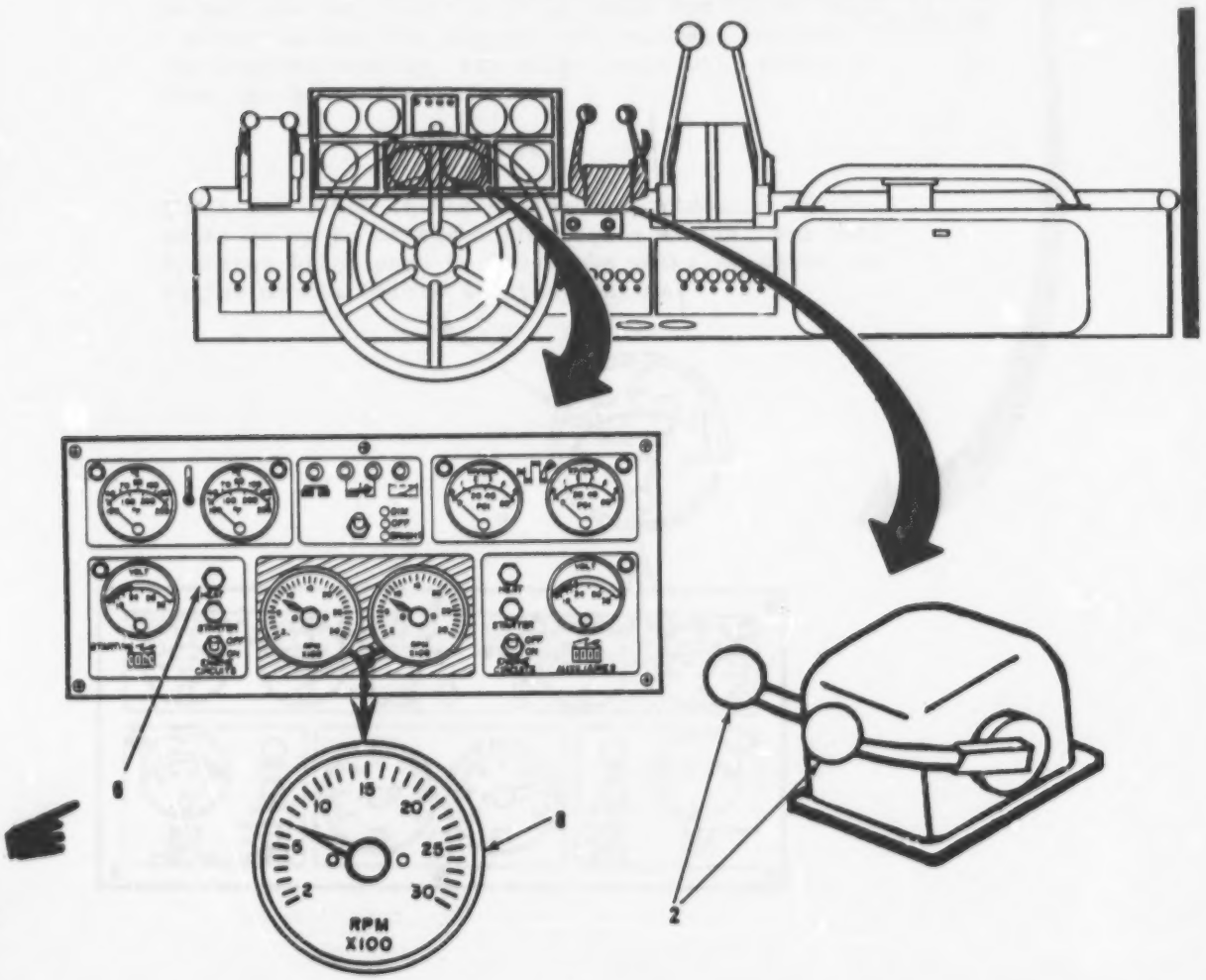
CAUTION

After engine starts observe oil pressure gage. If gage does not register 20 lb/in^2 (1.5 Kp/cm^2) pressure within 10 seconds shut down engine.

h. After engine starts continue to press heat switch (6) until engine is running smoothly.

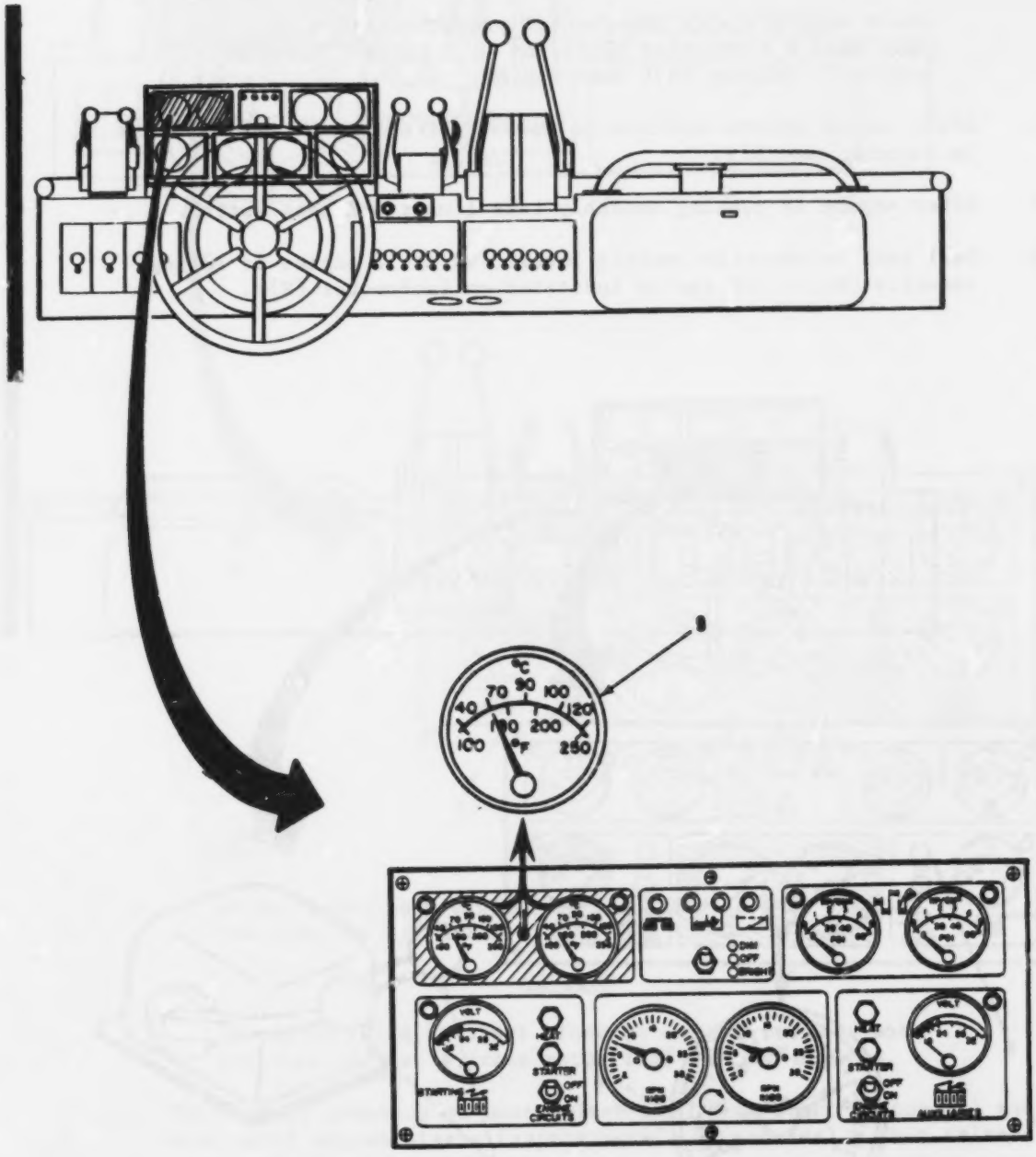
i. After engine is running smoothly take finger off heat switch.

j. Pull back on throttle control levers (2) until engine is idling smoothly (650 - 750 rpm as indicated on tachometer (8)).



k. Start the other engine using the same procedure.

l. After both engines have been started, move away from mooring as soon as possible. If you can, run the engines at 1800 to 2000 rpm under load until water temperature reads 140° - 158°F (60° - 70°C) as shown on temperature gages (9).



2-15. STARTING ENGINE (AFTER 4 WEEKS OR MORE OF NOT BEING USED)

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Do not start or operate engines with MK1 boat out of water. Severe engine damage will result.

For exception during organizational or higher maintenance, refer to TM 5-1940-277-20.

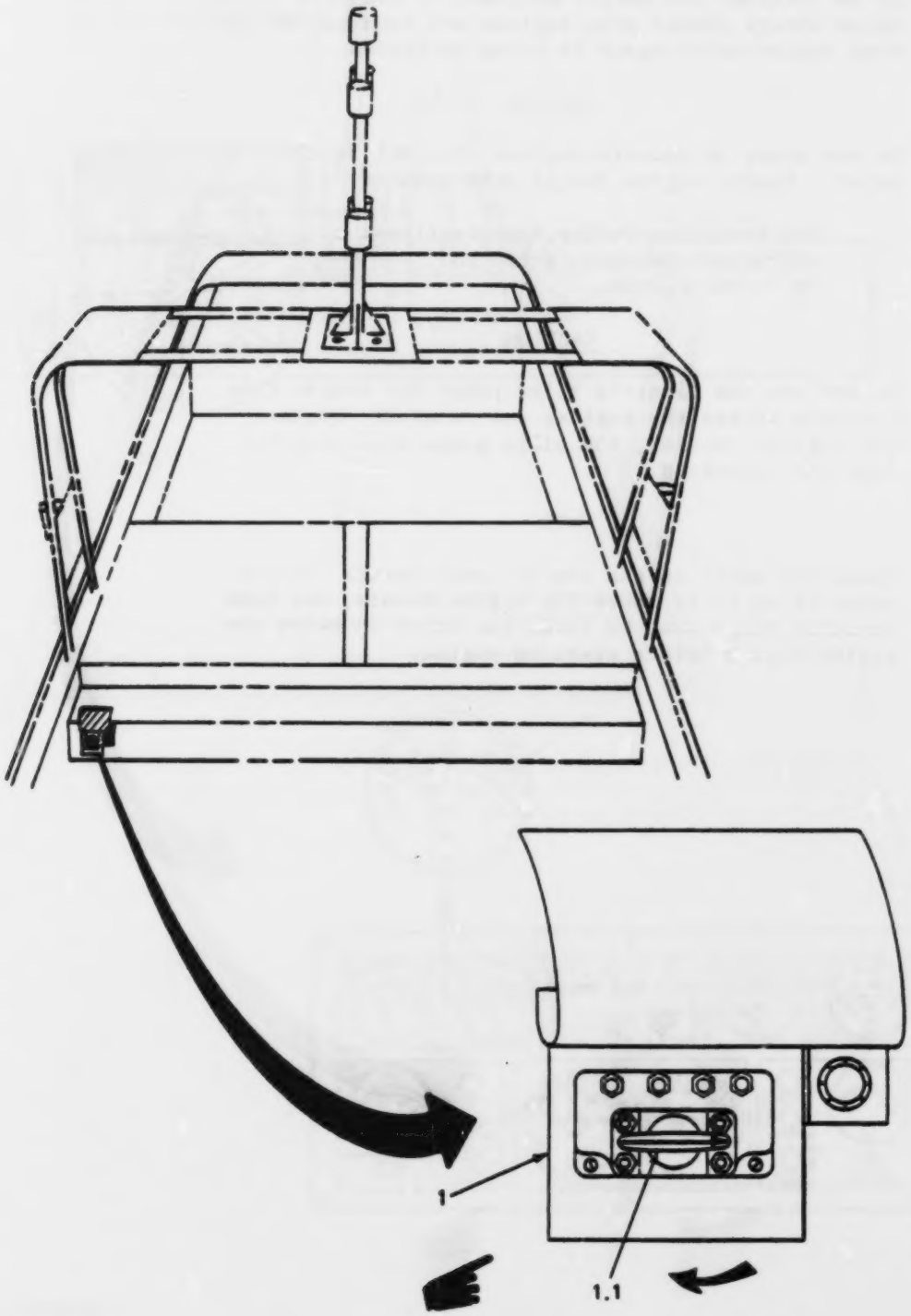
CAUTION

Do not use the electric bilge pumps for longer than 1 minute unless the engines are running. Without the engines running, the bilge pumps will soon run down the batteries.

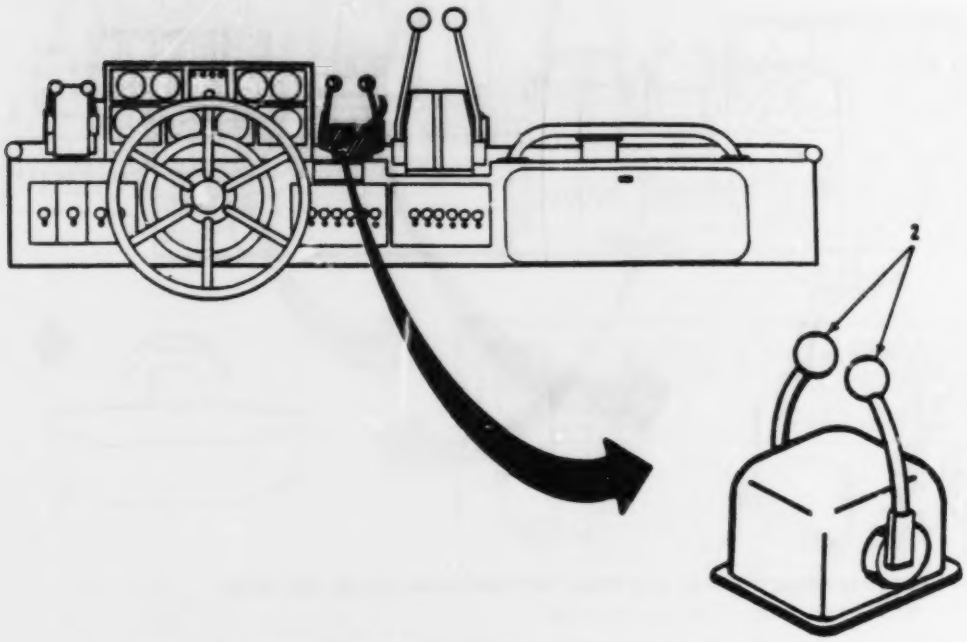
NOTE

Check for water in the engine compartment. If the water is up to or above the engine mounts, use hand operated bilge pump to lower the water to below the engine mounts before starting engine.

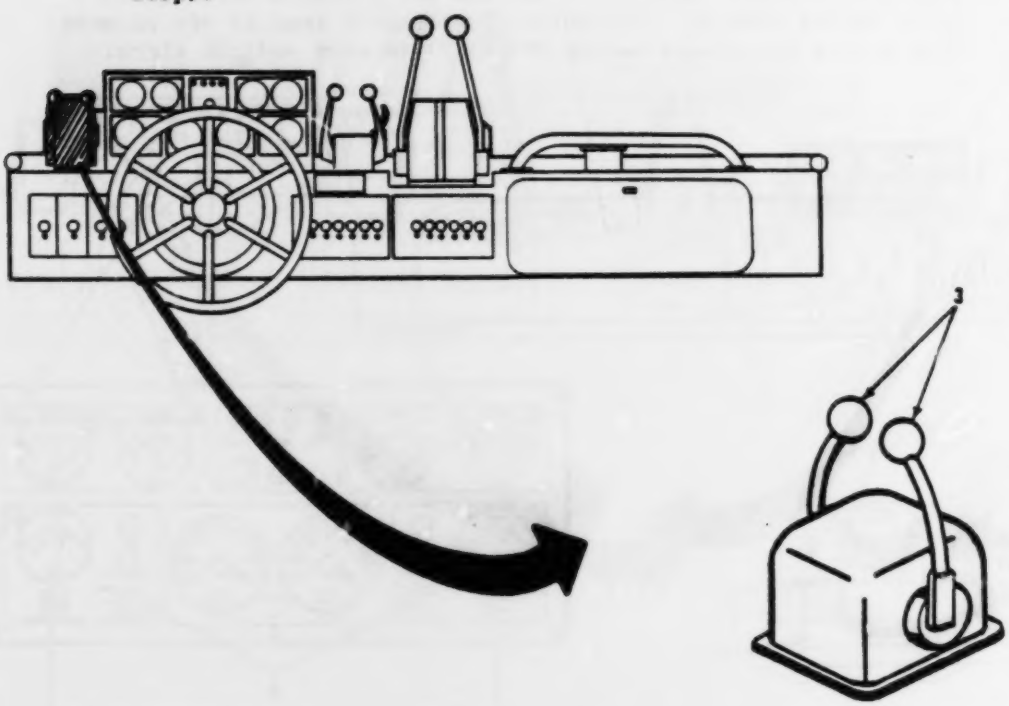
a. Turn master battery switch (1) ON by turning handle (1.1) clockwise until it stops.



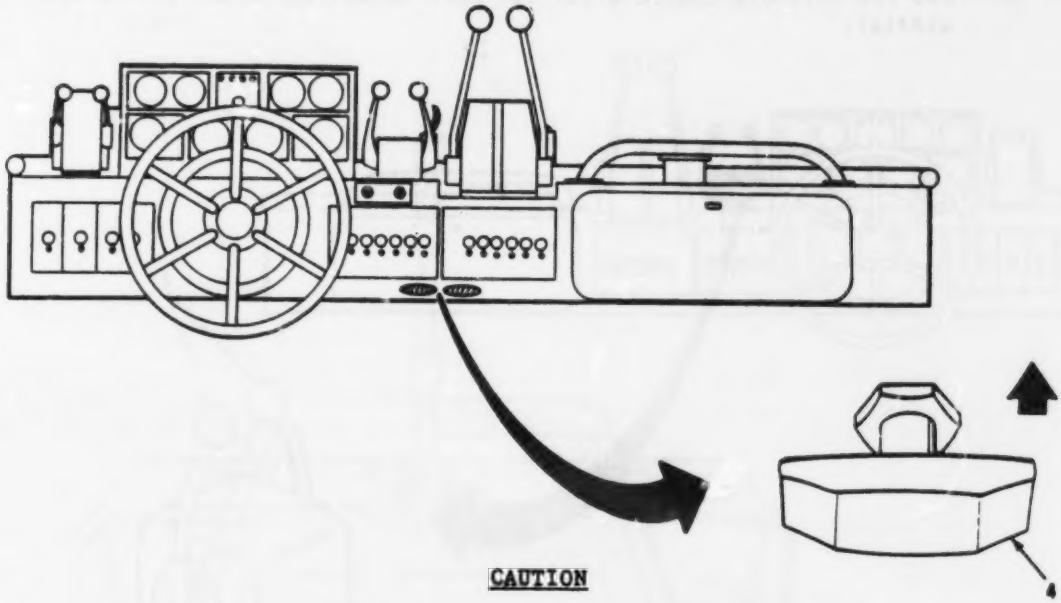
b. Set the throttle controls (2) for half speed (approximately in the middle).



c. Set the transmission control levers (3) in neutral position (center stop).



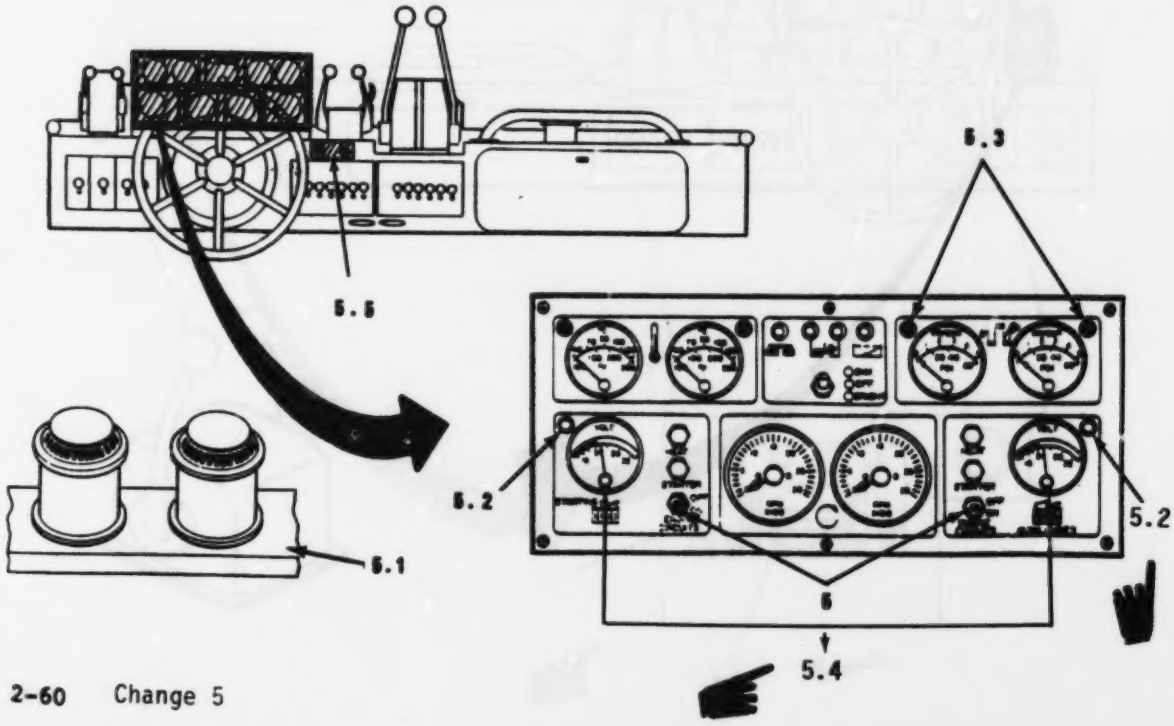
d. Pull engine stop controls (4) all the way out.



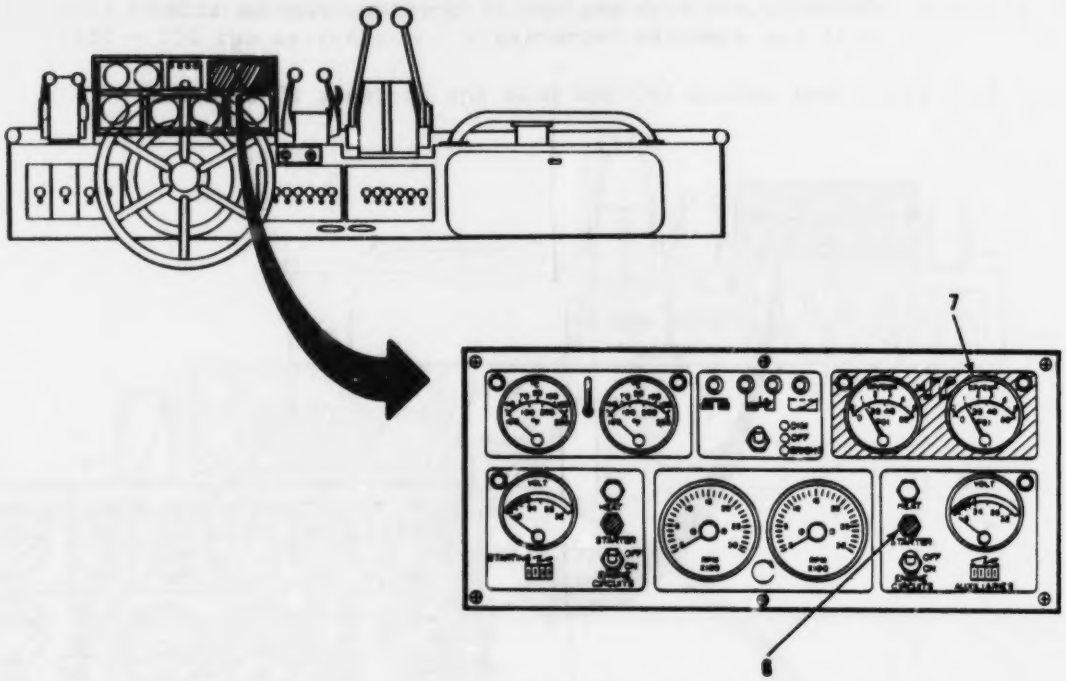
CAUTION

Do not start both engines at the same time as this will run down the batteries.

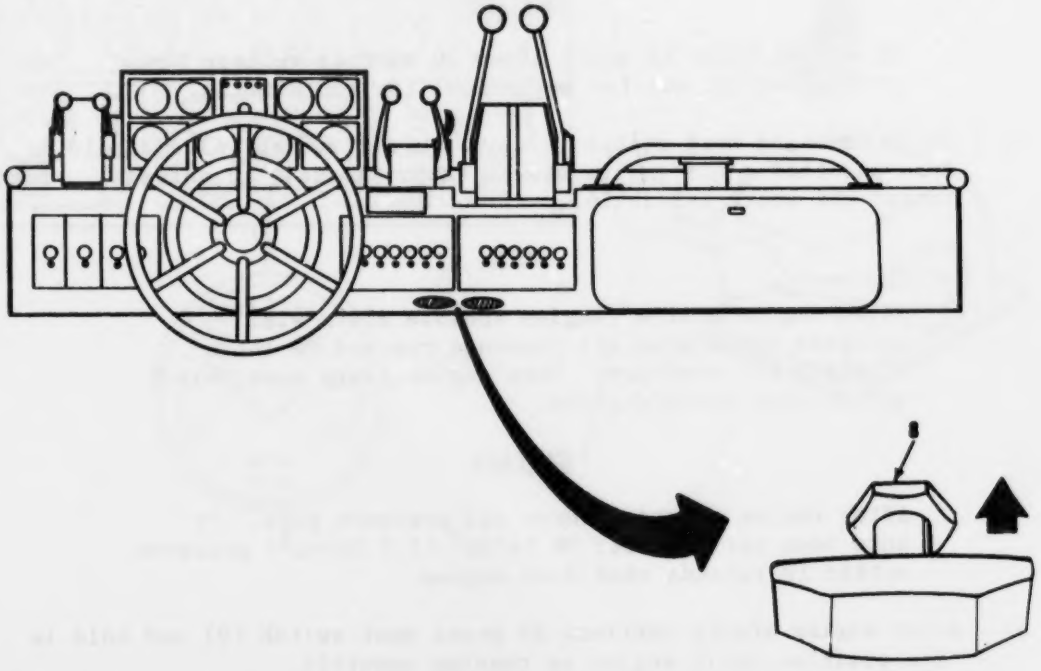
e. Set engine circuit switches (5) ON. Engine audible alarm (5.1), generator warning light (5.2) and low oil pressure warning light (5.3) should come on. Voltmeter (5.4) should read 25 vdc or more. Turn engine alarm mute switch OFF (5.5) to stop audible alarm.



f. Press start switch (6) and crank engine until oil pressure starts to register on the oil pressure gage (7) (approximately 10 seconds). Release start switch.



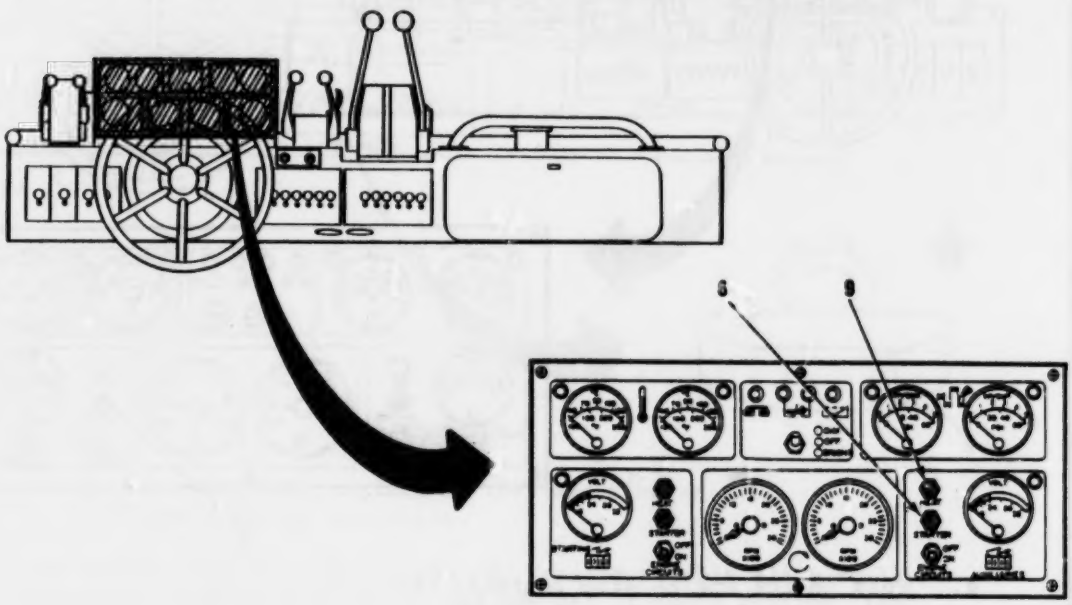
g. Push in the engine stop controls (8).



CAUTION

Do not start both engines at the same time as this will run down the batteries.

h. Press heat switch (9) and hold for at least 20 seconds.



CAUTION

If engine fails to start after 30 seconds release key switch and let starter motor cool for two minutes.

i. While pressing heat switch (9) press start switch (6) and hold in this position until engine starts (approximately 10 seconds). Take finger off start switch (6).

NOTE

After engine starts, engine audible alarm will activate again when oil pressure reaches 20 lb/in^2 (1.5 Kp/cm^2) pressure. Turn engine alarm mute switch OFF to stop audible alarm.

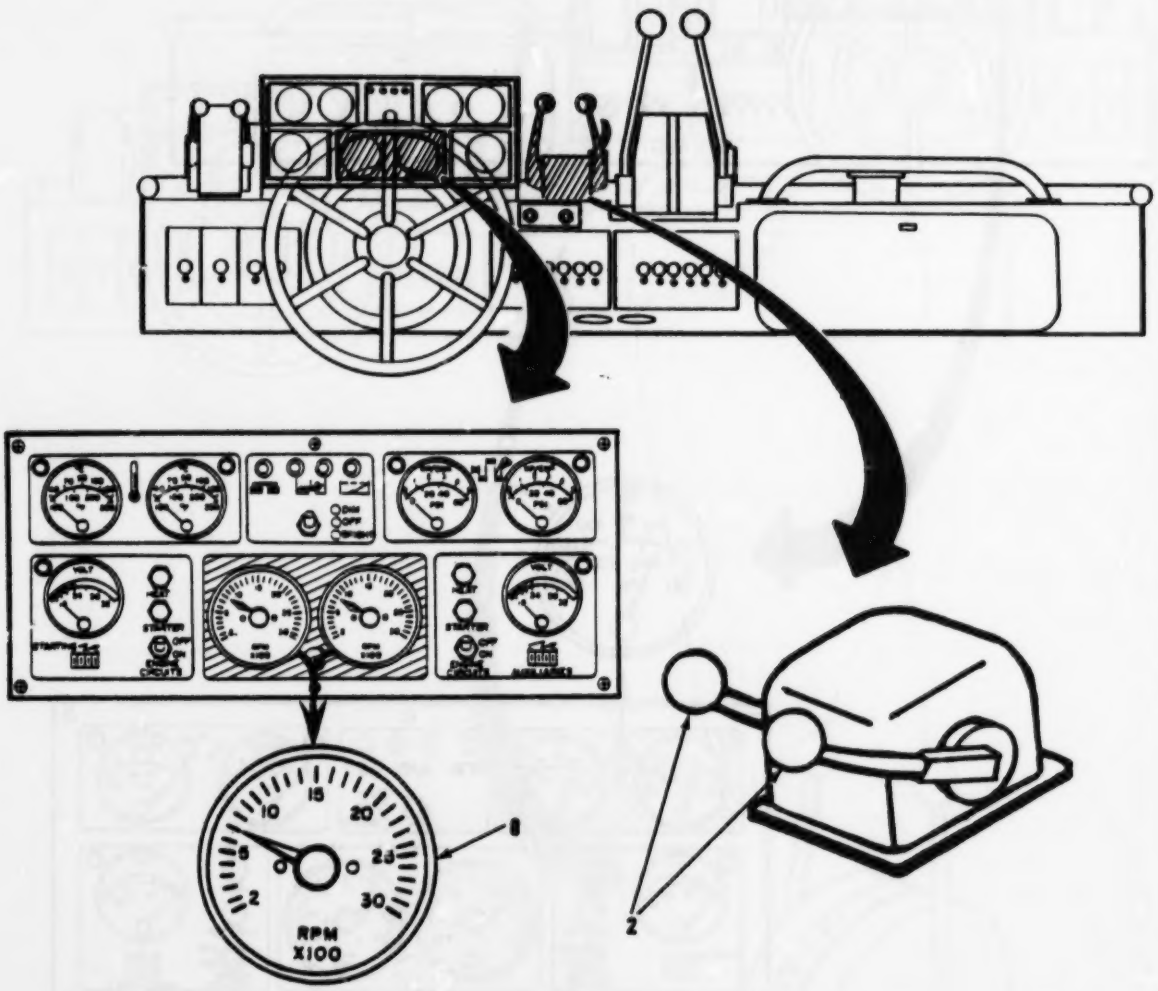
CAUTION

After engine starts observe oil pressure gage. If gage does not register 20 lb/in^2 (1.5 Kp/cm^2) pressure within 10 seconds shut down engine.

j. After engine starts continue to press heat switch (9) and hold in this position until engine is running smoothly.

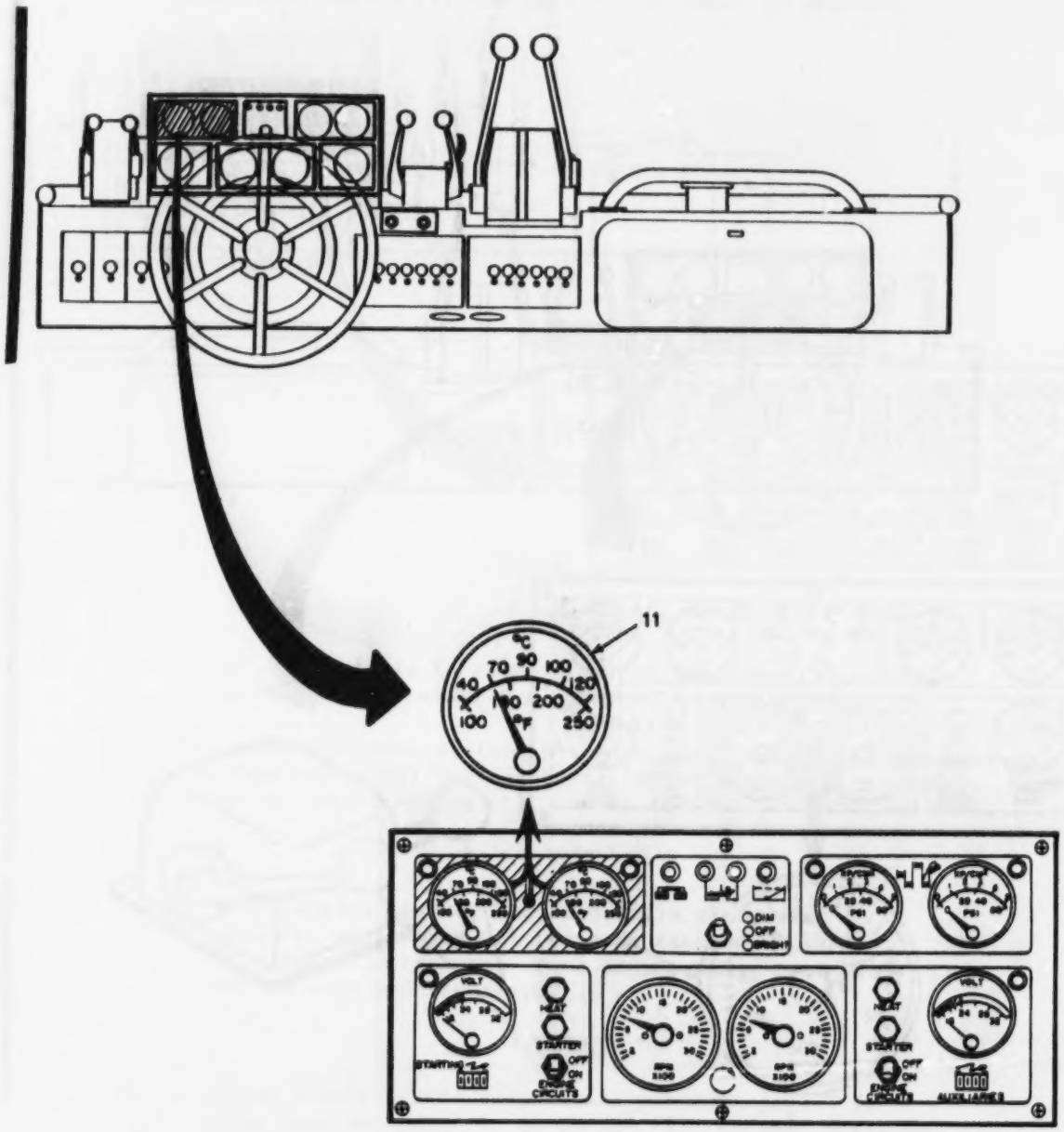
k. After engine is running smoothly take finger off heat switch (9).

1. Pull back on throttle control levers until engine is idling smoothly (650 - 750 rpm as indicated on tachometers (8)).



m. Start the other engine using same procedure.

n. After both engines have been started, move away from mooring as soon as possible. If you can, run the engines at 1800 to 2000 rpm under load until water temperature reads 140° - 158°F (60° - 70°C) as shown on temperature gages (11).

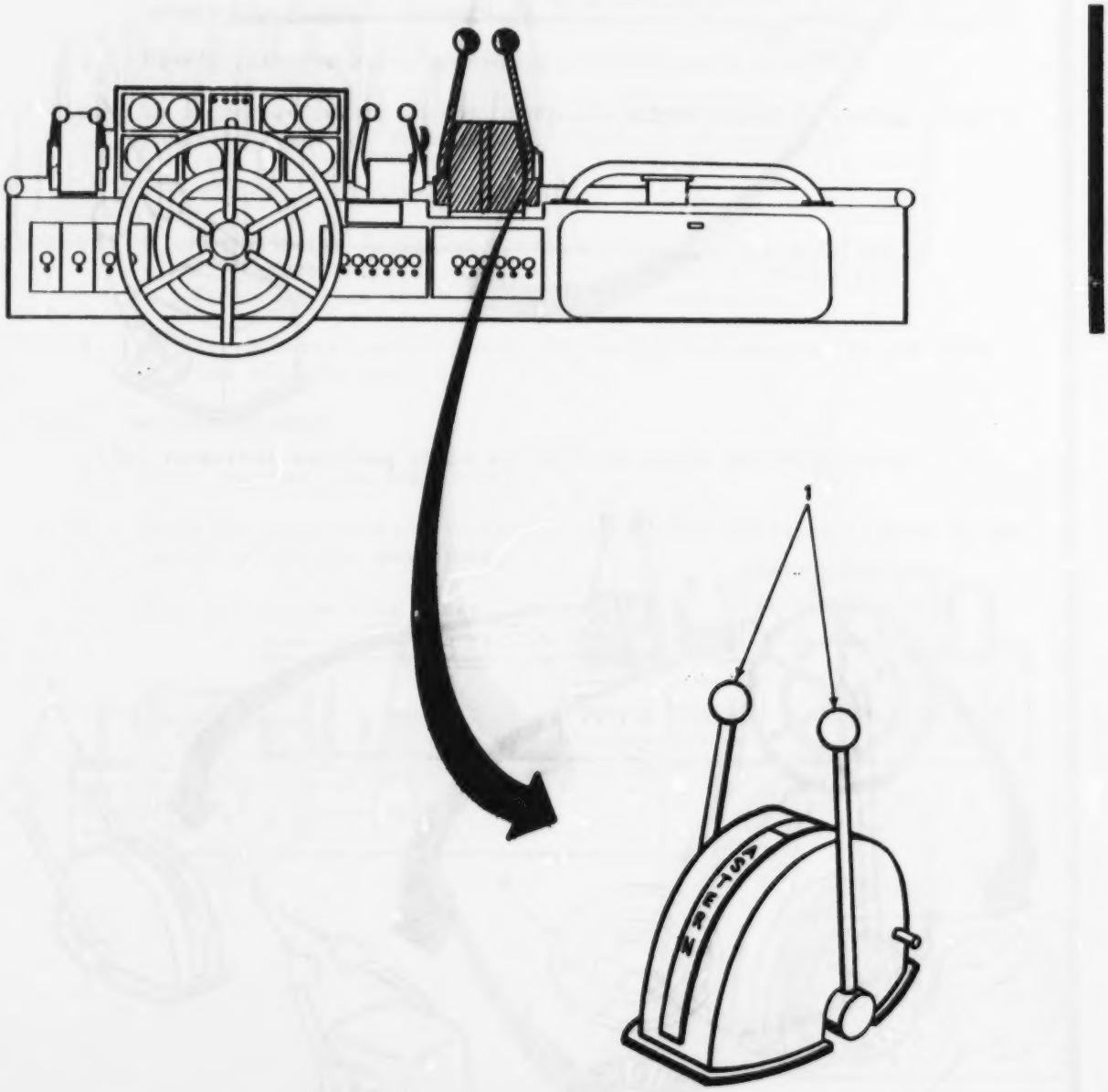


2-16. FORWARD MOVEMENT

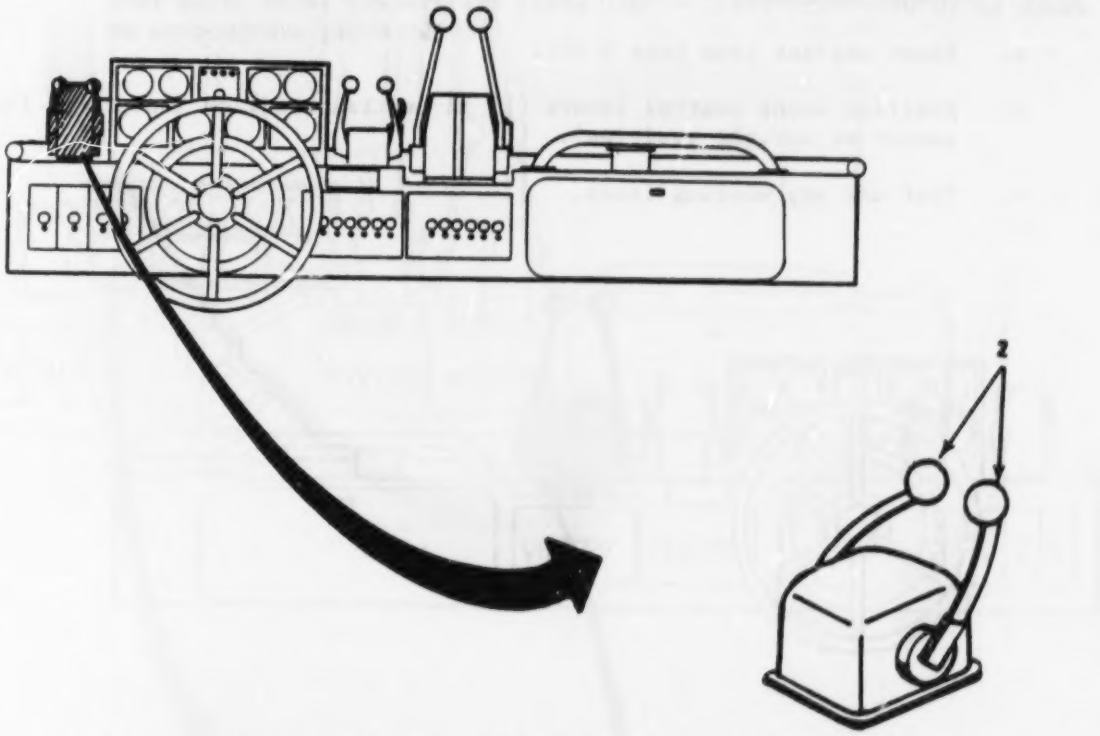
a. Start engines (see page 2-44).

b. Position scoop control levers (1) in neutral position (levers in the center or upright position).

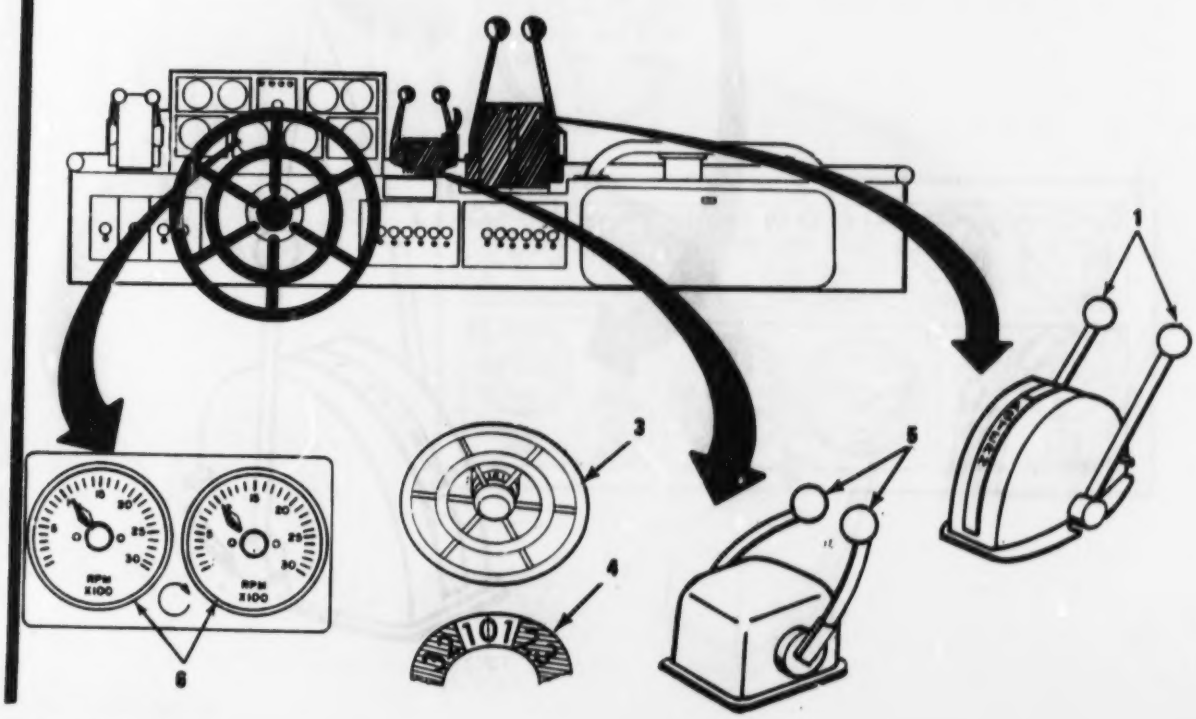
c. Cast off any mooring lines.



d. Position transmission control levers (2) in the forward position to start the hydrojets.



e. Center steering wheel (3) ("0" on scoop position indicator (4)).



WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

When under way, the transmission control levers should not be touched. Transmission damage may result.

f. Increase engine speed to 1000 rpm by moving both throttle control levers (5) slightly forward.

g. Slowly push the scoop control levers (1) fully forward.

h. To increase forward motion, increase engine speed by moving throttle control levers (5) forward.

NOTE

Any mismatch in engine speed or scoop control position will cause the boat to steer to the port or starboard direction when steering wheel (3) is centered.

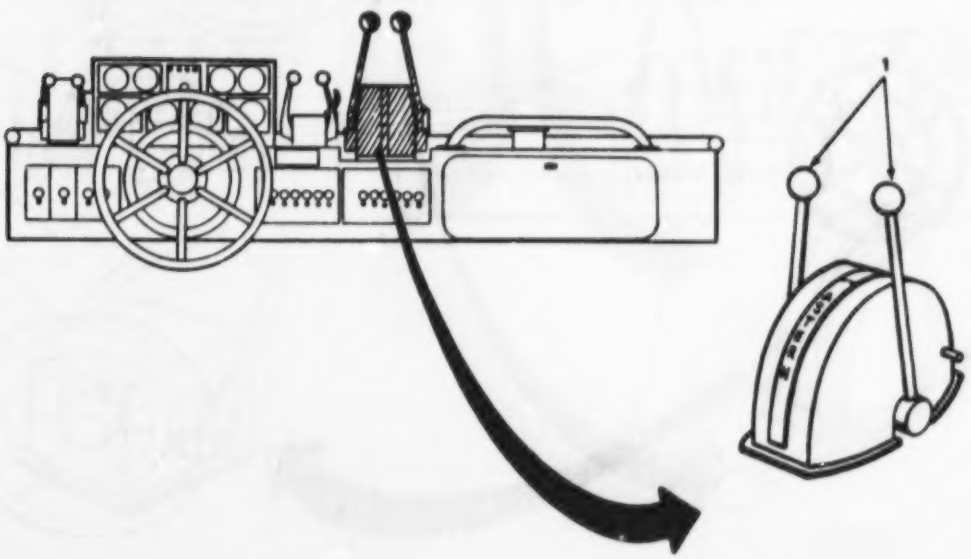
i. Adjust throttle control levers (5) until tachometers (6) for both engines read the same.

2-17. REVERSE MOVEMENT

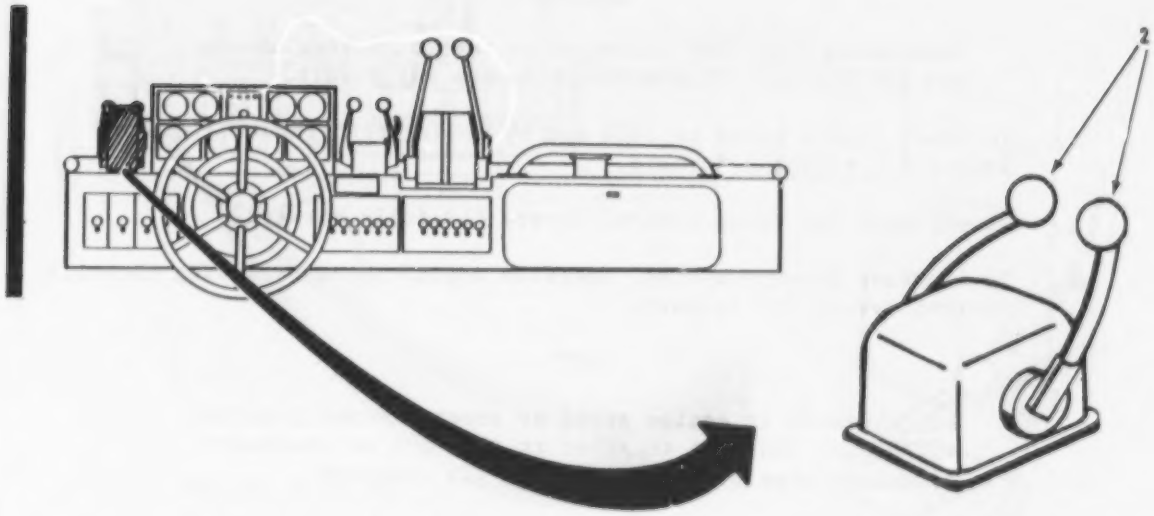
a. Start engines (see page 2-44).

b. Position scoop control levers (1) in neutral position (levers in the center or upright position).

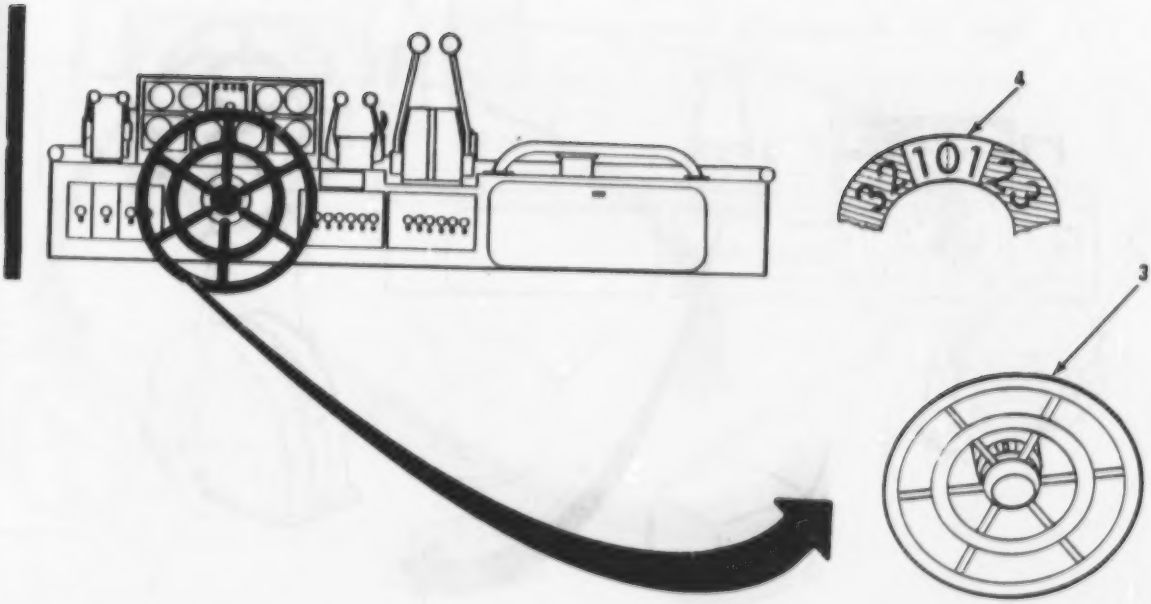
c. Cast off any mooring lines.



d. Position transmission control levers (2) in the forward position to start the hydrojets.



e. Center steering wheel (3) ("0" on scoop position indicator (4)).



CAUTION

When under way, the transmission control levers should not be touched. Transmission damage may result.

f. Increase engine speed to 1000 rpm by moving both throttle control levers (5) slightly forward.

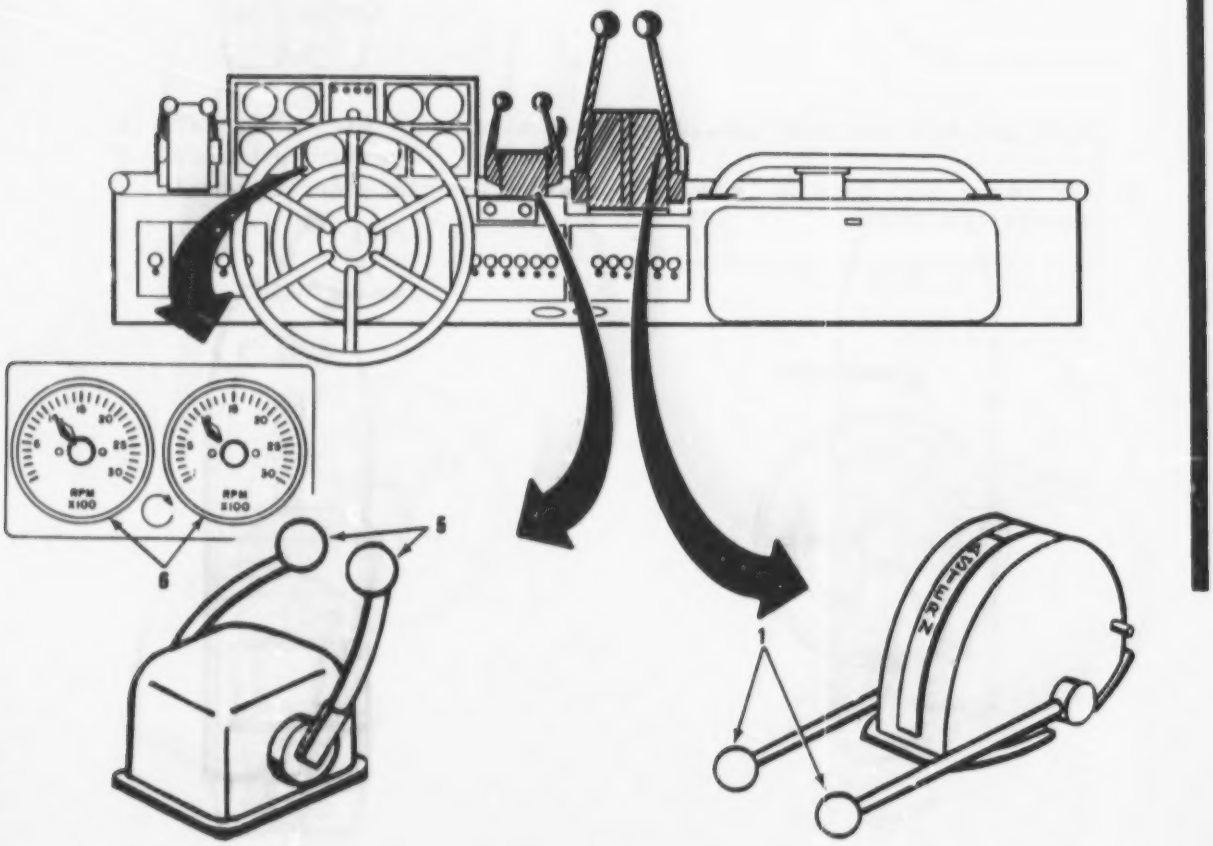
g. Slowly pull the scoop control levers (1) fully backward.

h. To increase reverse motion, increase engine speed by moving throttle control levers (5) forward.

NOTE

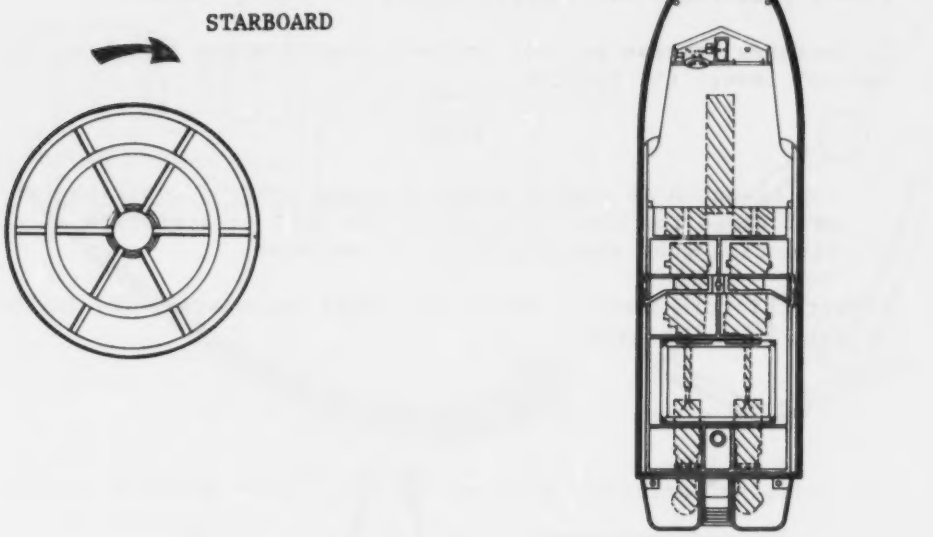
Any mismatch in engine speed or scoop control position will cause the boat to steer to the port or starboard direction when steering wheel is centered.

i. Adjust throttle control levers (5) until tachometers (6) for both engines read the same.

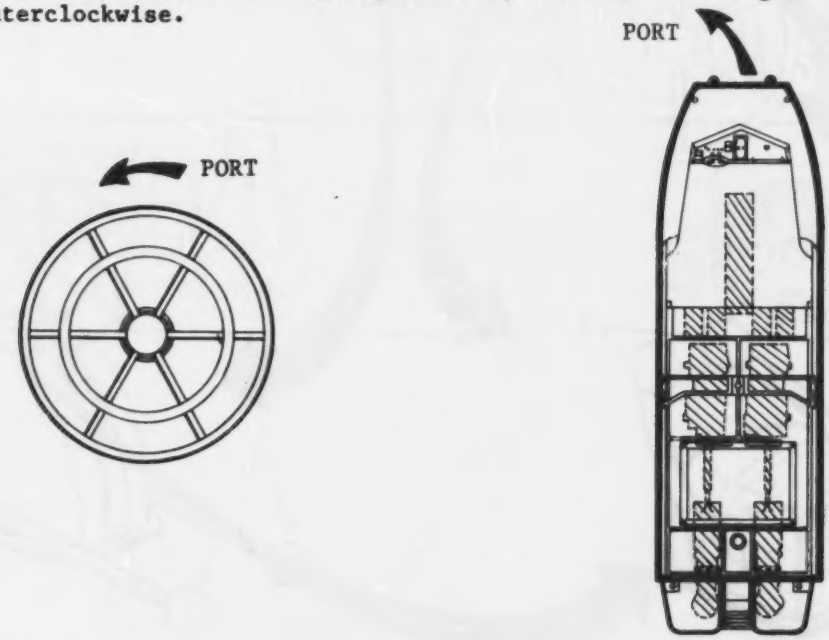


2-18. STEERING, USING STEERING WHEEL

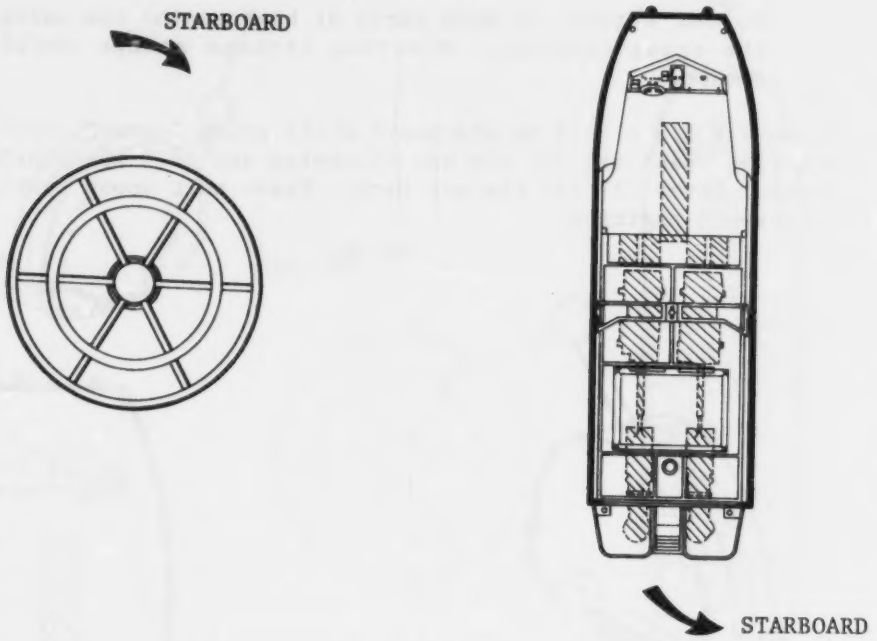
a. To make a starboard turn while going forward, turn the steering wheel clockwise.



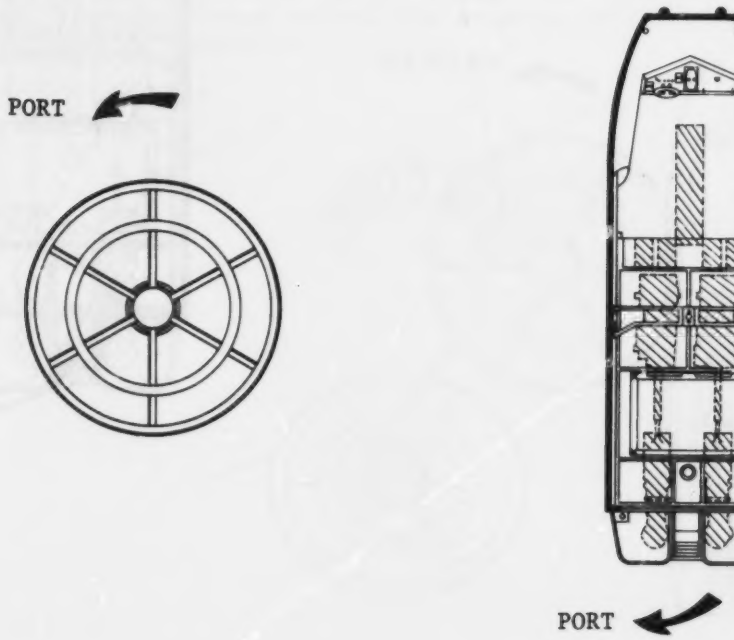
b. To make a port turn while going forward, turn the steering wheel counterclockwise.



c. To make a starboard turn while going backward, turn the steering wheel clockwise.



d. To make a port turn while going backward, turn the steering wheel counterclockwise.

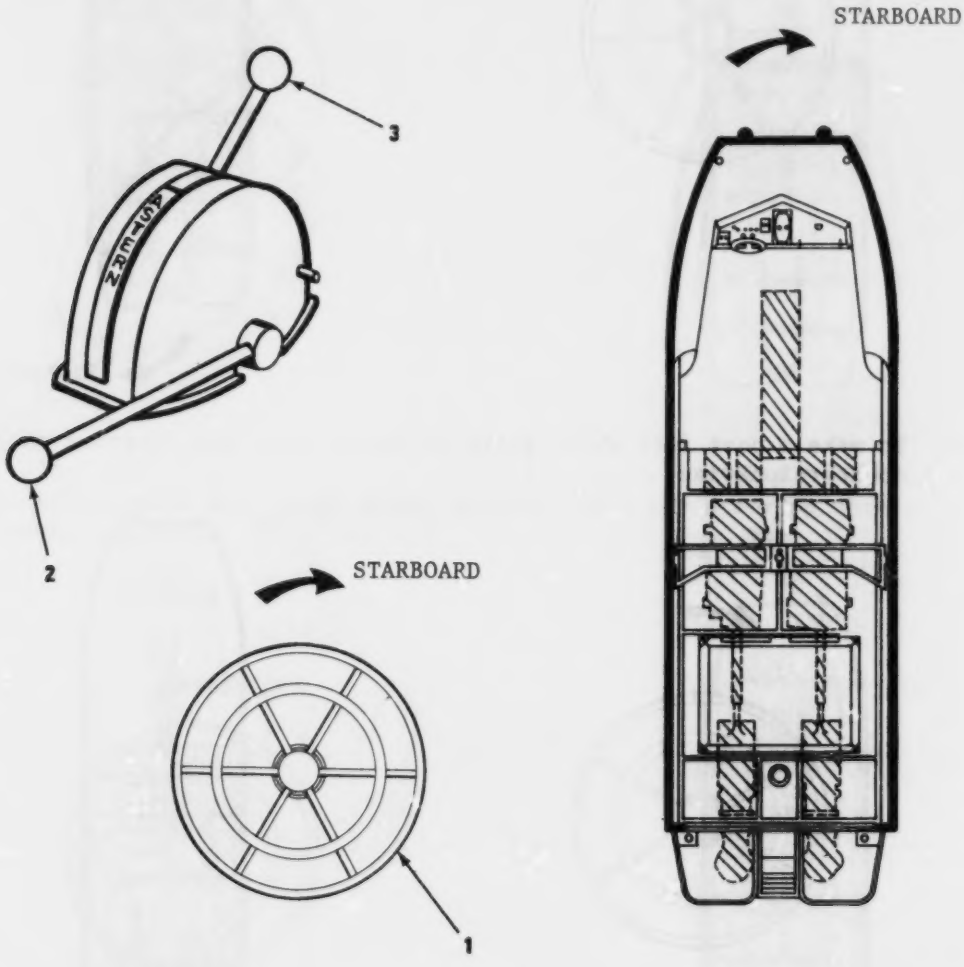


2-19. STEERING, USING STEERING WHEEL AND SCOOP CONTROL

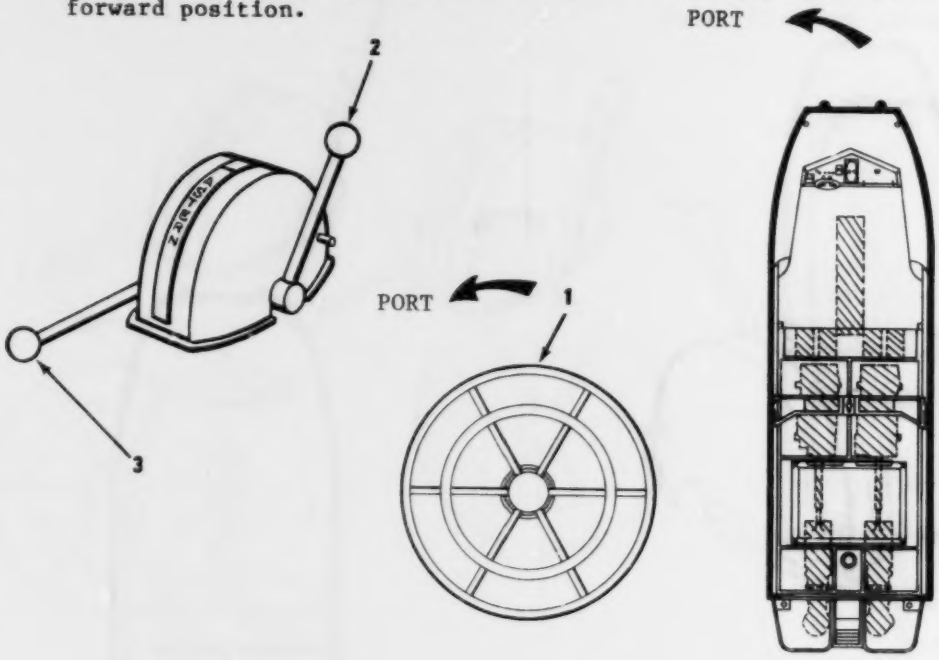
CAUTION

Do not attempt to make turns at high engine rpm using the scoop control. Steering linkage damage could result.

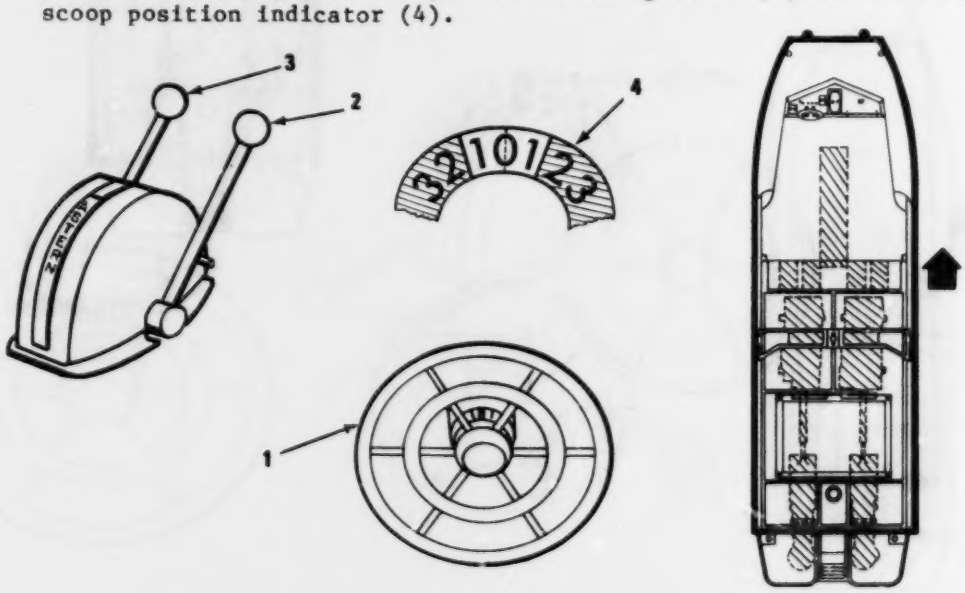
a. To make a tight turn to starboard while going forward, turn the steering wheel (1) all the way clockwise and pull the starboard scoop control lever (2) all the way back. Leave port scoop control lever (3) in forward position.



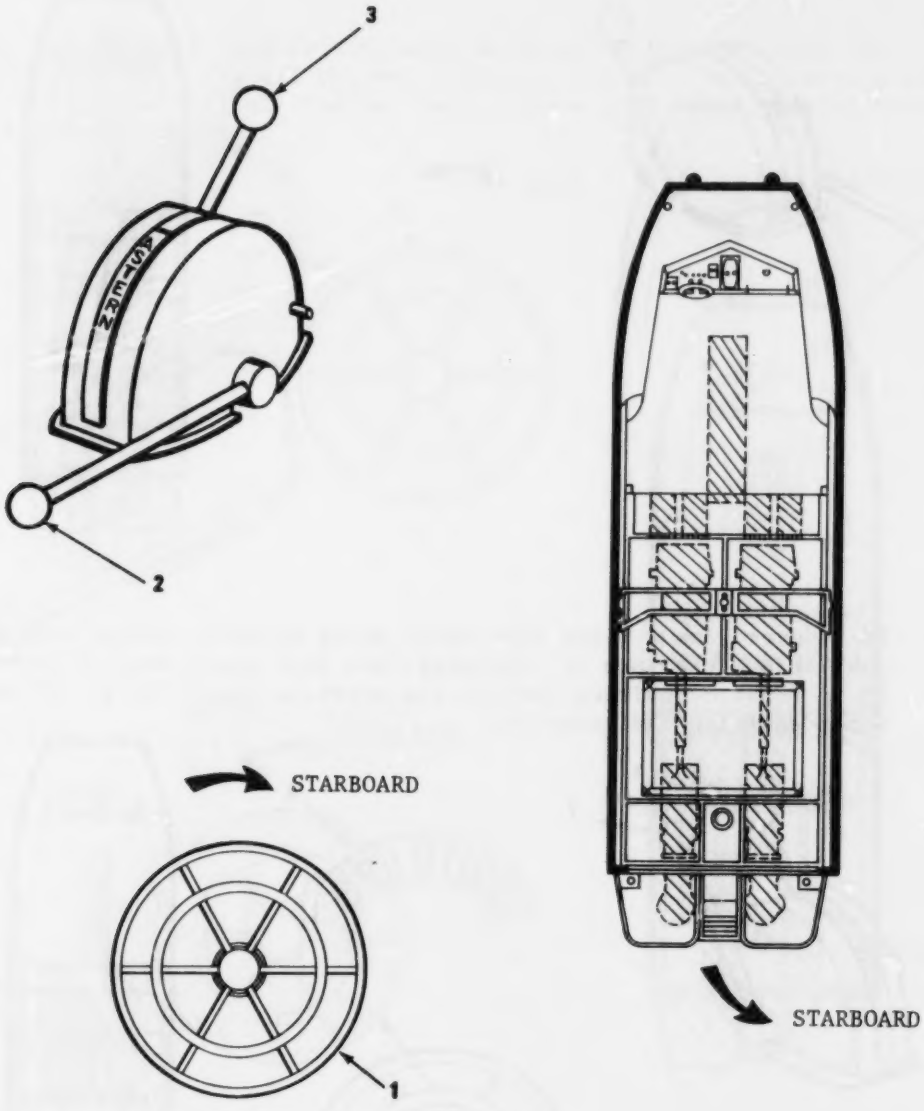
b. To make a tight turn to port while going forward, turn the steering wheel (1) all the way counterclockwise and pull the port scoop control lever (3) all the way back. Leave starboard scoop control lever (2) in forward position.



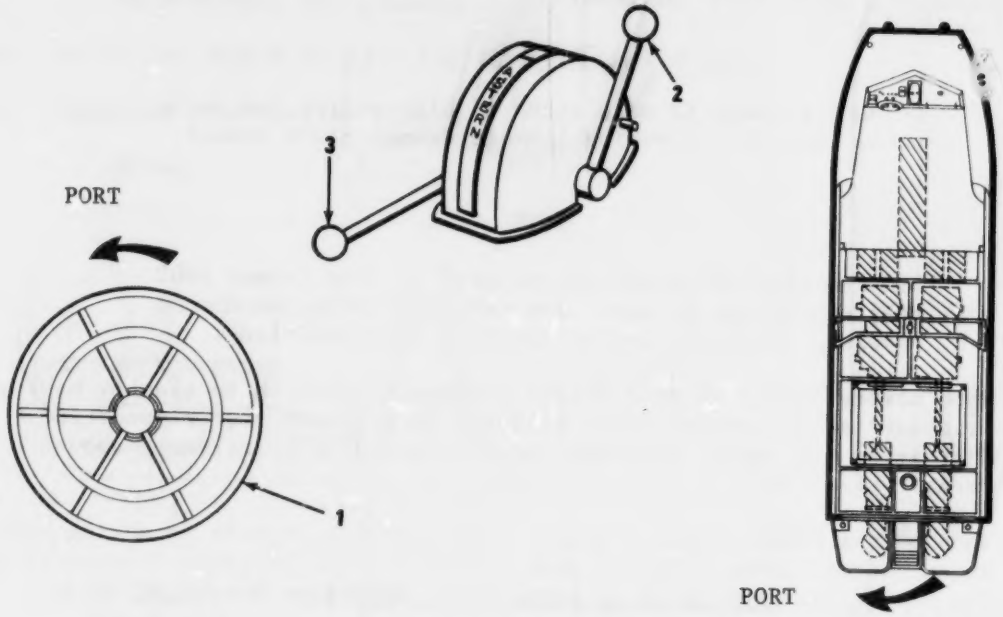
c. To recover from a tight turn while going forward, reduce engine rpm and just before the turn is completed, put back scoop control levers (2 and 3) in forward position and put the steering wheel (1) at "0" on the scoop position indicator (4).



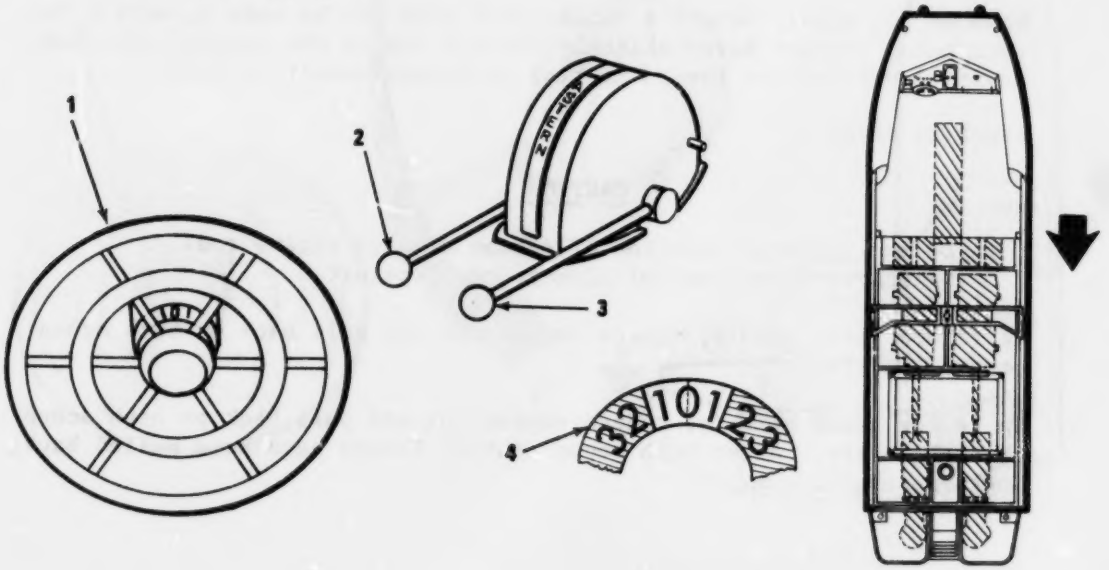
d. To make a tight turn to starboard while going backward, turn the steering wheel (1) all the way clockwise and push the port scoop control lever (3) all the way forward. Leave the starboard scoop control lever (2) back.



e. To make a tight turn to port while going backward, turn the steering wheel (1) all the way counterclockwise and push the starboard scoop control lever (2) all the way forward. Leave port scoop control lever (3) back.



f. To recover from a tight turn while going backward, reduce engine rpm and just before the turn is completed pull both scoop control levers (2 and 3) back and put the steering wheel (1) at "0" on the scoop position indicator (4) .



NOTE

Using both steering wheel and scoop controls, you can make the boat turn within its own length.

2-20. STEERING, USING SCOOP CONTROLS

CAUTION

Do not attempt to make turns at high engine rpm using scoop control. Steering linkage damage could result.

NOTE

This method of steering is used at low (about 1000 rpm) engine rpm to make slow and fine adjustments to heading. Commonly called "inching into position".

a. When moving slowly ahead a slight starboard turn can be made by moving starboard scoop control lever slightly back toward neutral position. Increasing the amount that the lever is moved back increases amount of turn.

b. When moving slowly ahead a slight port turn can be made by moving port scoop control lever slightly back toward neutral position. Increasing the amount that the lever is moved back, increases amount of turn.

c. When moving slowly backward a slight starboard turn can be made by moving the starboard scoop control lever slightly forward toward the neutral position. Moving lever further toward neutral increases amount of turn.

d. When moving slowly astern a slight port turn can be made by moving the port scoop control lever slightly forward toward the neutral position. Moving lever further toward neutral increases amount of turn.

2-21. REDUCING SPEED

CAUTION

Do not reverse position of scoops at high engine rpm. Damage to scoop control linkage could result.

a. To reduce speed slowly, reduce engine rpm and pull back on both scoop control levers.

b. To reduce speed quickly, reduce engine rpm and pull back on both scoop control levers. After both scoop control levers have been pulled back, increase engine rpm.

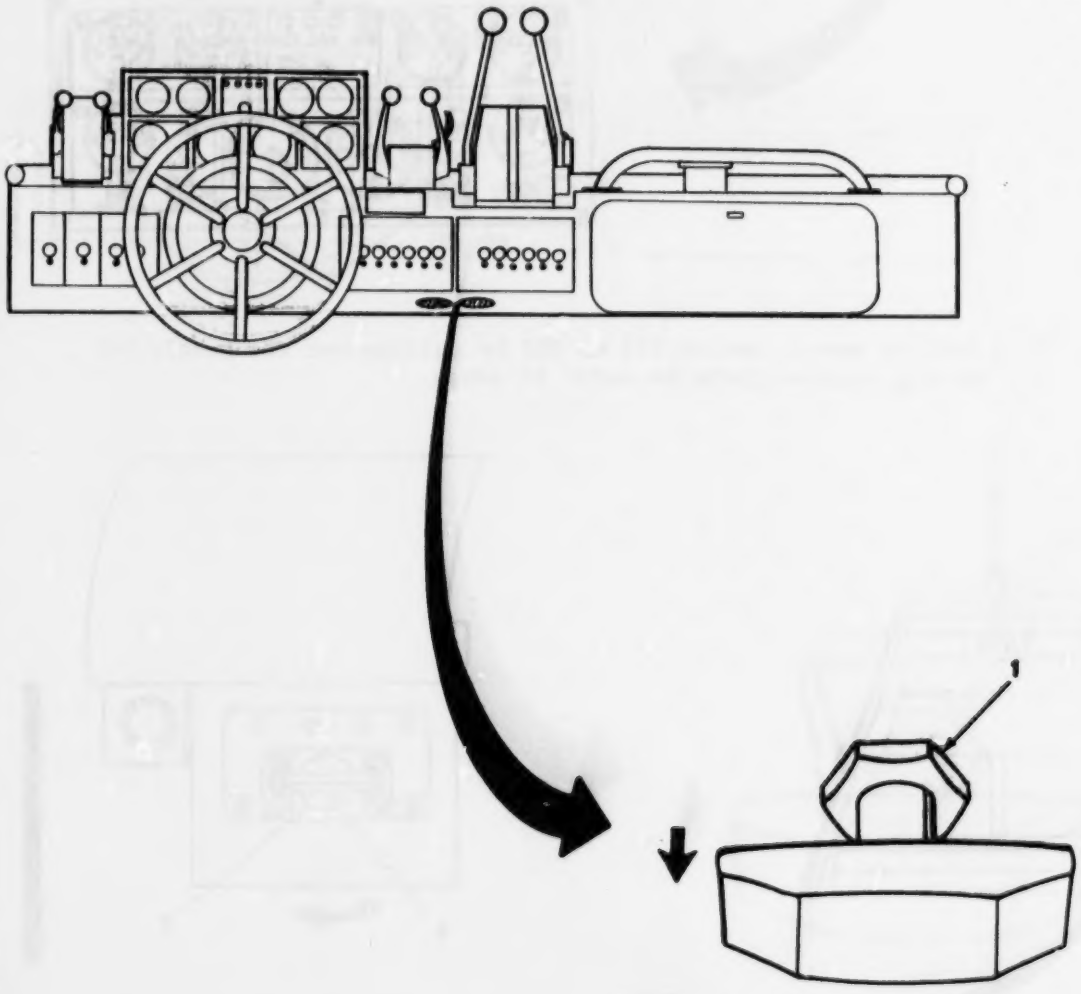
2-22. STOPPING ENGINES

CAUTION

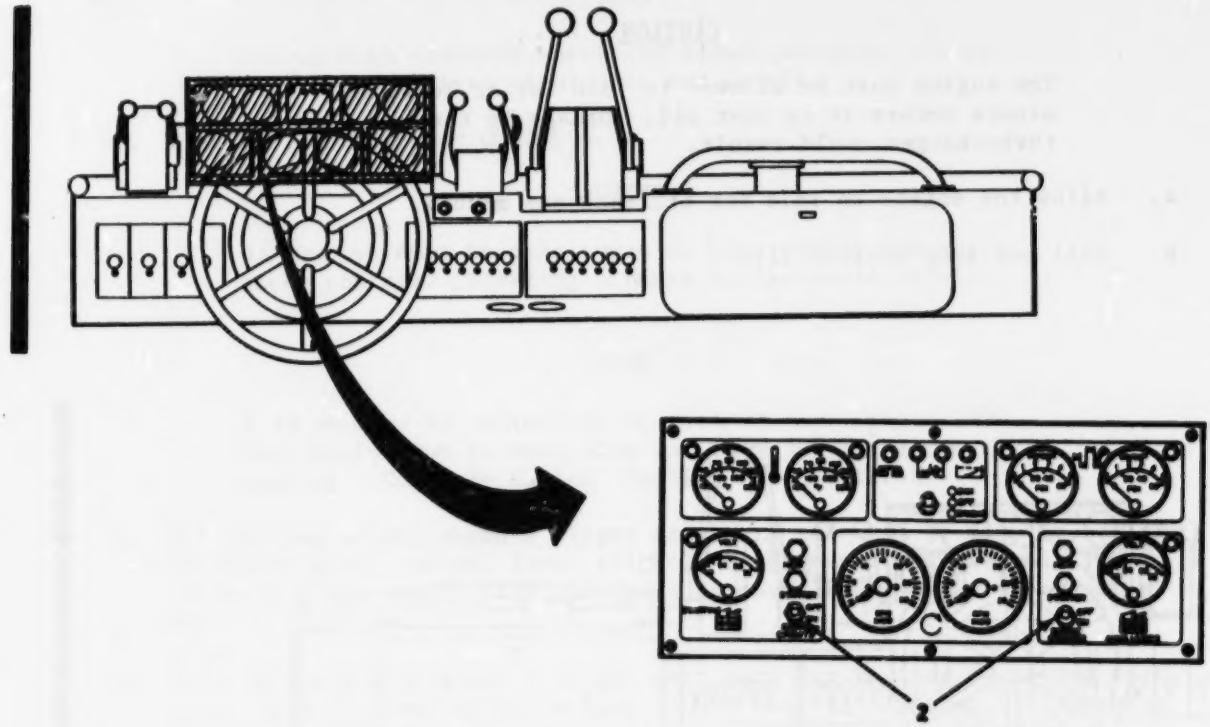
The engine must be allowed to idle for at least one minute before it is shut off. Damage to the turbocharger could result.

a. Allow the engine to idle for at least one minute.

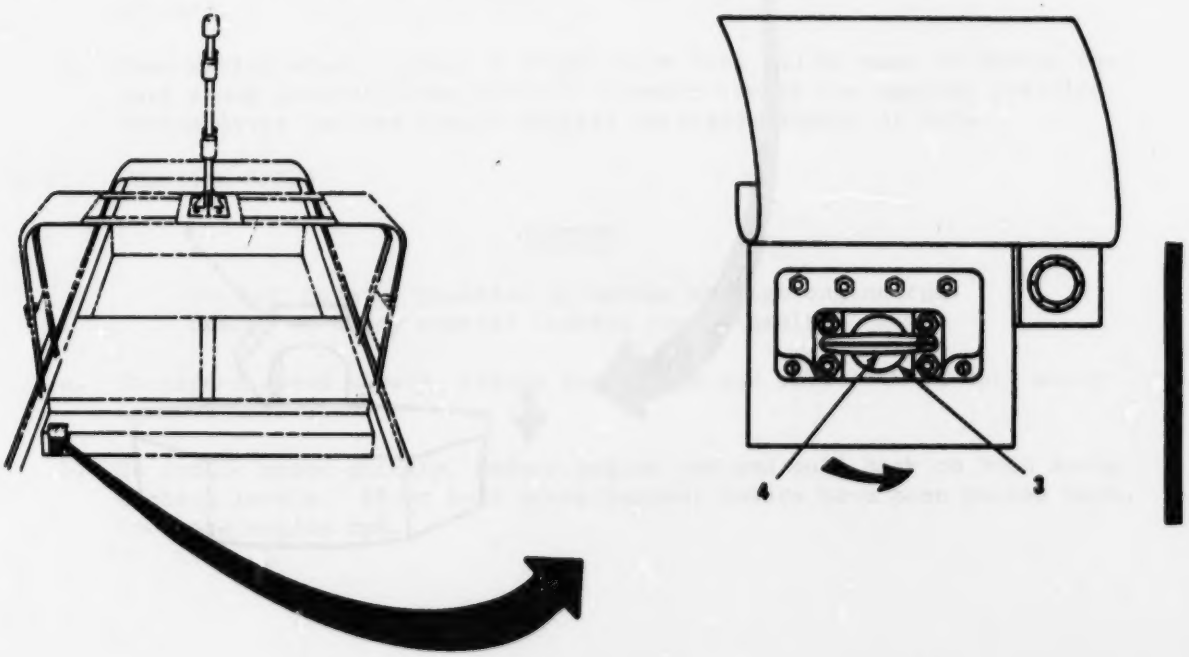
b. Pull out stop control (1).

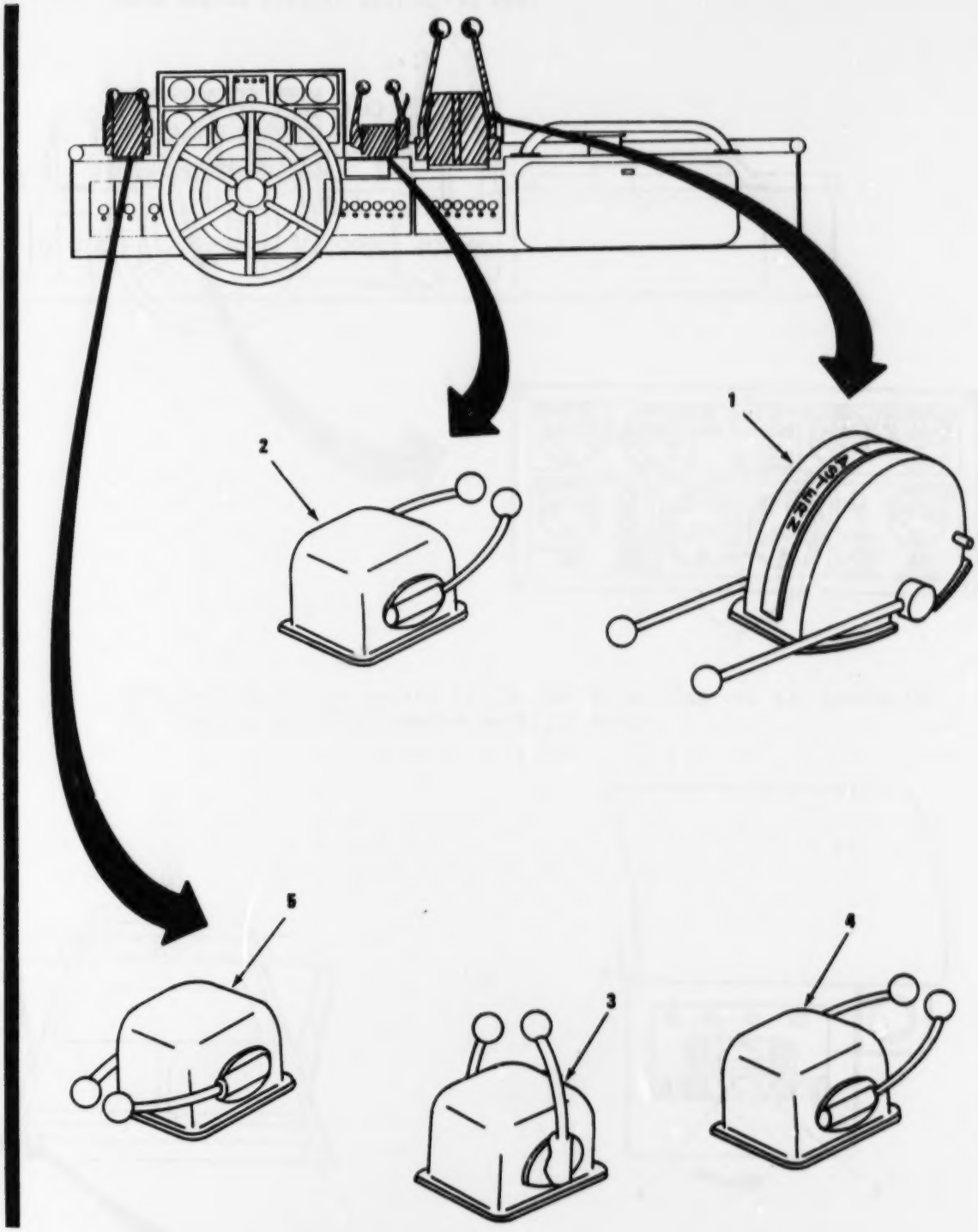


c. Turn engine circuit switch (2) OFF.



d. Turn battery master switch (3) to OFF by pulling out the handle (4) and turning counterclockwise until it stops.

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2-23. CLEARING GRILLES (WATER JET INTAKE)

CAUTION

The following procedure is to be used only for clearing the hydrojet intake grilles. It is not to be used to maneuver the boat. Damage to hydrojets could occur.

a. Decrease engine speed to 1000 rpm or less.

b. Push scoop control levers (1) all the way forward.

c. Pull transmission control levers (2) all the way back. Stop control levers at neutral position (3) for brief period.

d. Increase engine speed (4) to high rpm for 2 to 3 seconds and then return engine speed to 1000 rpm or less.

e. Push transmission control levers to neutral position (straight up) or all the way forward (5).

2-24. GETTING UNDER WAY FORWARD FROM BERTH

CAUTION

Ropes and mooring lines can be sucked into hydrojets. Avoid running over ropes or lines.

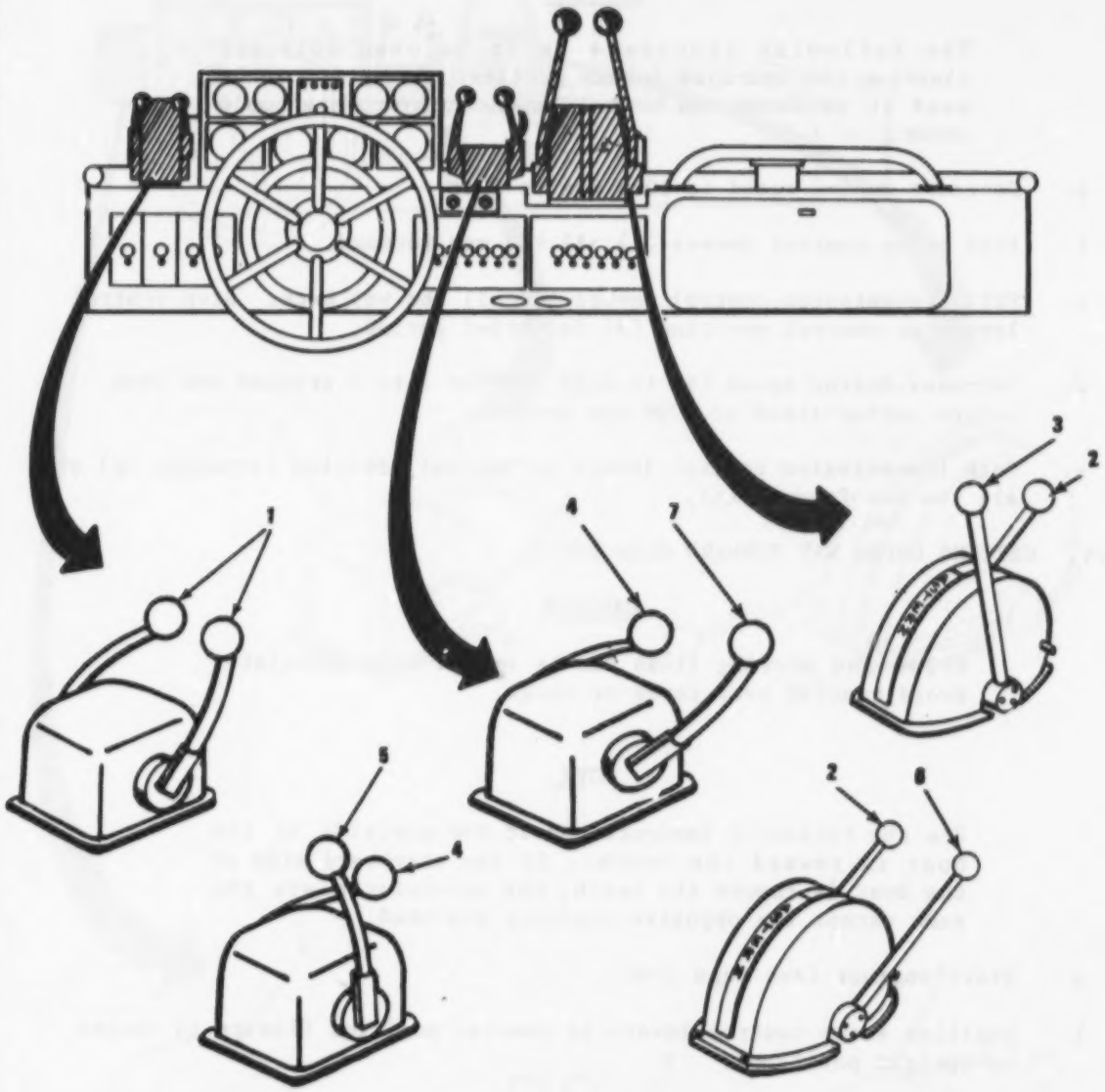
NOTE

Use the following instructions if the portside of the boat is toward the berth. If the starboard side of the boat is toward the berth, the procedures are the same except the opposite controls are used.

a. Start engines (see page 2-44).

b. Position scoop control levers in neutral position (levers in center or upright position).

c. Cast off all mooring lines.



d. Push transmission control levers (1) all the way forward.

e. Push port scoop control lever (2) all the way forward leaving the starboard scoop control lever (3) in neutral.

f. Push the port throttle control lever (4) slowly forward leaving the starboard throttle control lever (5) at idle speed.

g. When the boat is clear of the berth, push the starboard scoop control lever (6) and the starboard throttle control lever (7) forward until they are in the same position as the port control levers (2)(4).

2-25. GETTING UNDER WAY ASTERN FROM BERTH

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Ropes and mooring lines can be sucked into hydrojets. Avoid running over ropes or lines.

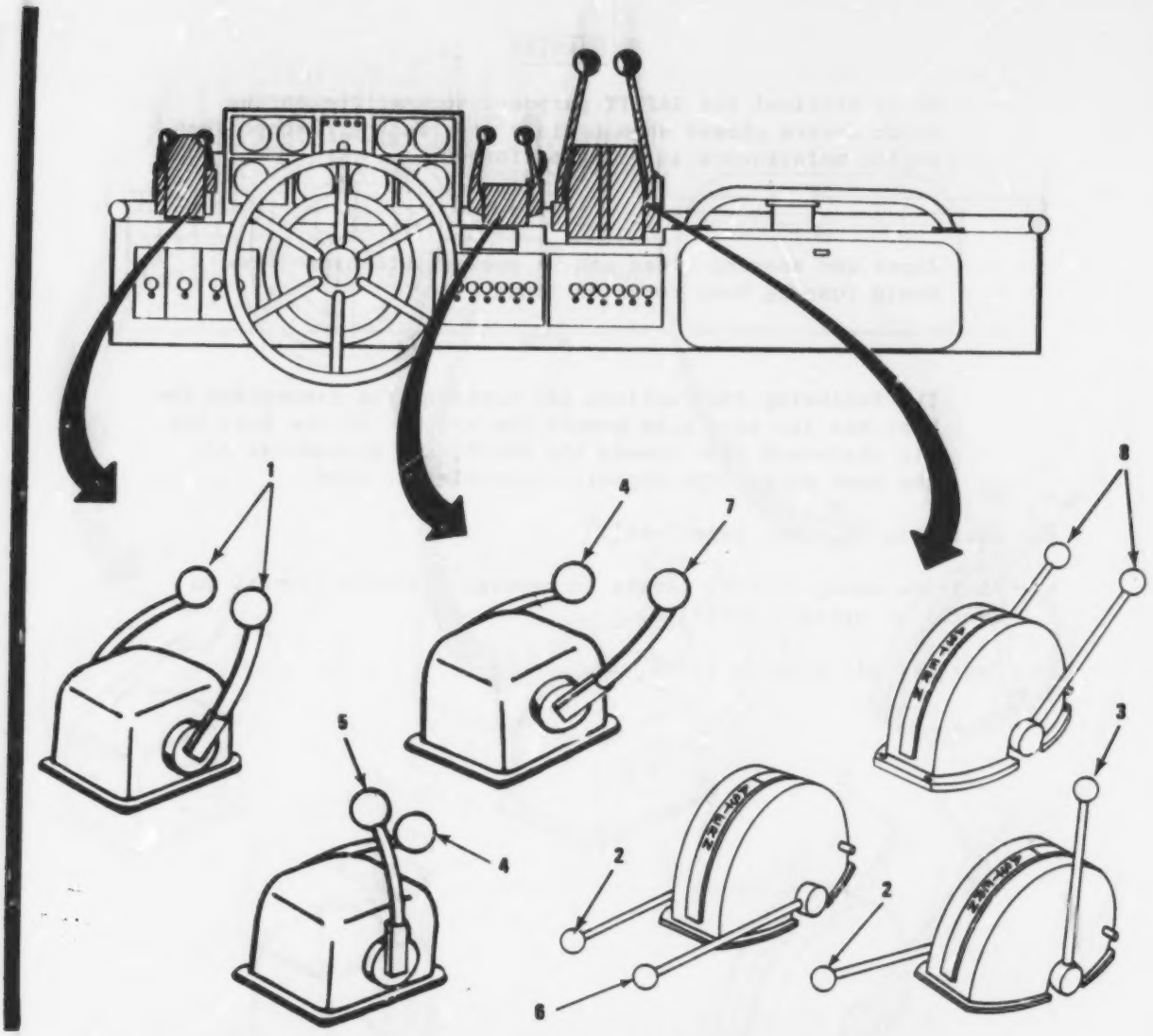
NOTE

The following instructions are based on the assumption the boat has its port side toward the berth. If the boat has its starboard side toward the berth, the procedures are the same except the opposite controls are used.

a. Start engines (see page 2-44).

b. Position scoop control levers in neutral position (levers in center or upright position).

c. Cast off all mooring lines.



d. Push transmission control levers (1) all the way forward.

e. Pull port scoop control lever (2) all the way back leaving the starboard scoop control lever (3) in neutral.

f. Push the port throttle control lever (4) slowly forward leaving the starboard throttle control lever (5) at idle speed.

g. When the boat is clear of the berth, pull the starboard scoop control lever (6) back and push the starboard throttle control lever (7) forward until they are in the same position as the port control levers.

h. When ready to go forward, cut engine rpm to 750 - 800, push both scoop controls (8) forward and increase engine rpm to desired speed.

2-26. INSTRUCTIONS FOR BOAT OPERATOR AND CREW DURING LAUNCH AND RETRIEVAL

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Prior to launch the bilge plug must be installed. Water will enter boat and cause damage.

a. Controlled launch (0 - 5 feet per second).

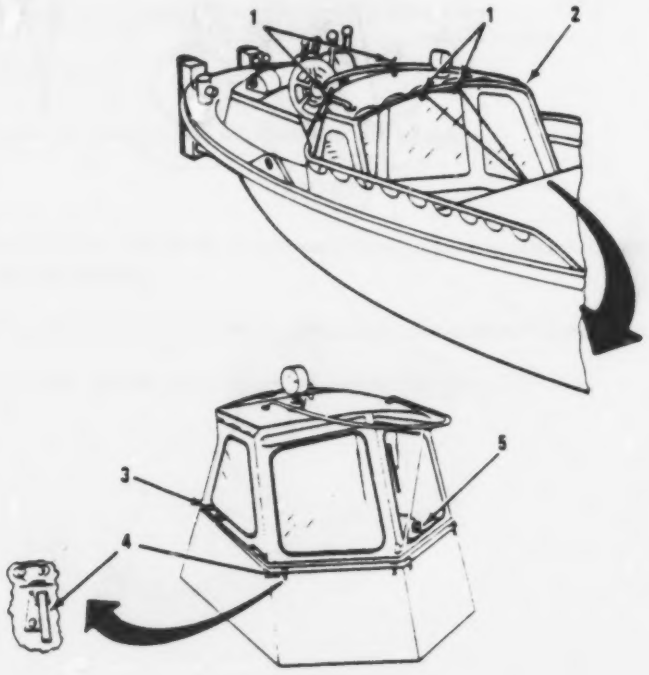
(1) Operator and crew will help prepare the boat for launch by:

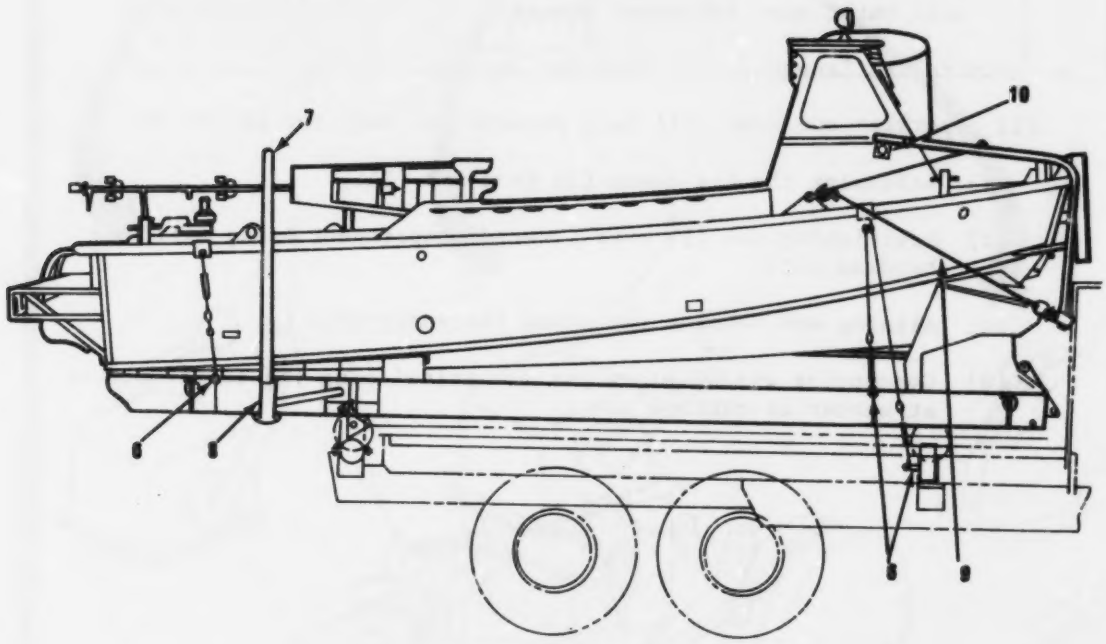
(a) Releasing the tie downs (1) from cab (2).

(b) Positioning cab (2) over forward compartment using lifting handles (3).

(c) Alining and closing cab clamp fasteners (4).

(d) Connecting windshield wiper electrical plug (5) to receptacle at center of control panel.

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(e) Removing six tiedowns (6) and placing them on transporter walkway.

(f) Removing upstream aft stanchion (7) by pulling retaining pin (8) out and lifting stanchion out of socket. Placing stanchion on transporter walkway and reinstalling retaining pin.

(2) When cradle is lowered and boat stern is floating operator will:

(a) Start engine (refer to page 2-44).

(b) Place transmission in forward (refer to page 2-1).

CAUTION

Do not apply too much power and overrun saddle. Cables will retension and cannot be released. Also damage to boat or cradle could result.

NOTE

Under some wind and current conditions turning wheel to one side or the other while powering ahead will provide additional slack in cable to ease its release.

(c) Advance throttles slightly to cause boat to advance just enough to slacken restraining cables (9).

(3) The crew will:

(a) Disconnect the cable hooks from the lifting point shackles when cable tension is released.

(b) Place cable hooks in forward stanchion eyes (10).

(4) The boat operator will:

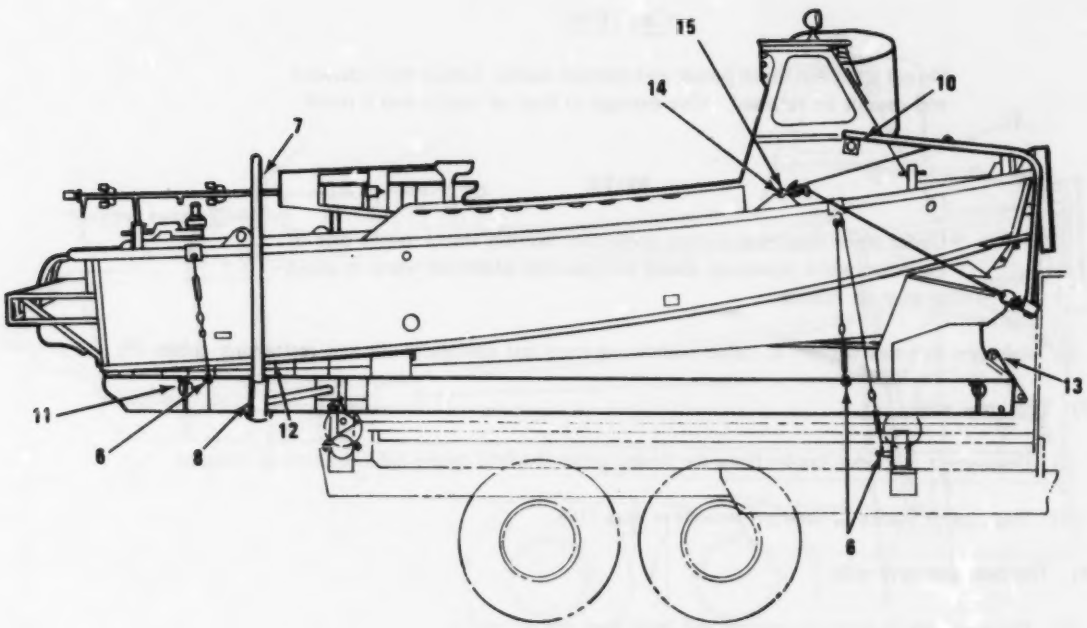
(a) Place scoops in reverse position and back boat out of cradle.

CAUTION

Insure cable is on inside of rear stanchions to prevent damage to forward stanchions.

(b) Raise mast to upright position and pin in place, ensure the electrical connector is properly connected.

(c) Go to normal boat operation procedures. (Refer to page 1-16).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WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

b. Free launch (above 5 feet per second).

(1) Operator and crew will help prepare the boat for launch by:

(a) Install cab (refer to page 2-83).

(b) Removing six tiedowns (6) and placing them on the transporter walkways.

(c) Removing two aft stanchions (7) by pulling the retaining pins (8) and lifting stanchions out of sockets.

(d) Placing stanchions on transporter walkways and replacing retaining pins.

(e) Removing shackle from cradle lifing point (11) and installing in the 1-3/8 inch hole in keel towing place (12).

(f) Removing dolly cable guide (latch book) (13) by pulling the pin retainer then removing pin and block.

(g) Disconnecting winch connection from cradle dolly and connecting to shackle in boat keel.

NOTE

The transporter operator will take a series of actions to position the transporter and boat before next step.

(h) When transporter operator gives the signal, the boat operator and crew will remove the shackle pins (14) from the retaining cable shackles (15).

(i) Shackles will be removed from cable hooks and reinstalled to lifting points.

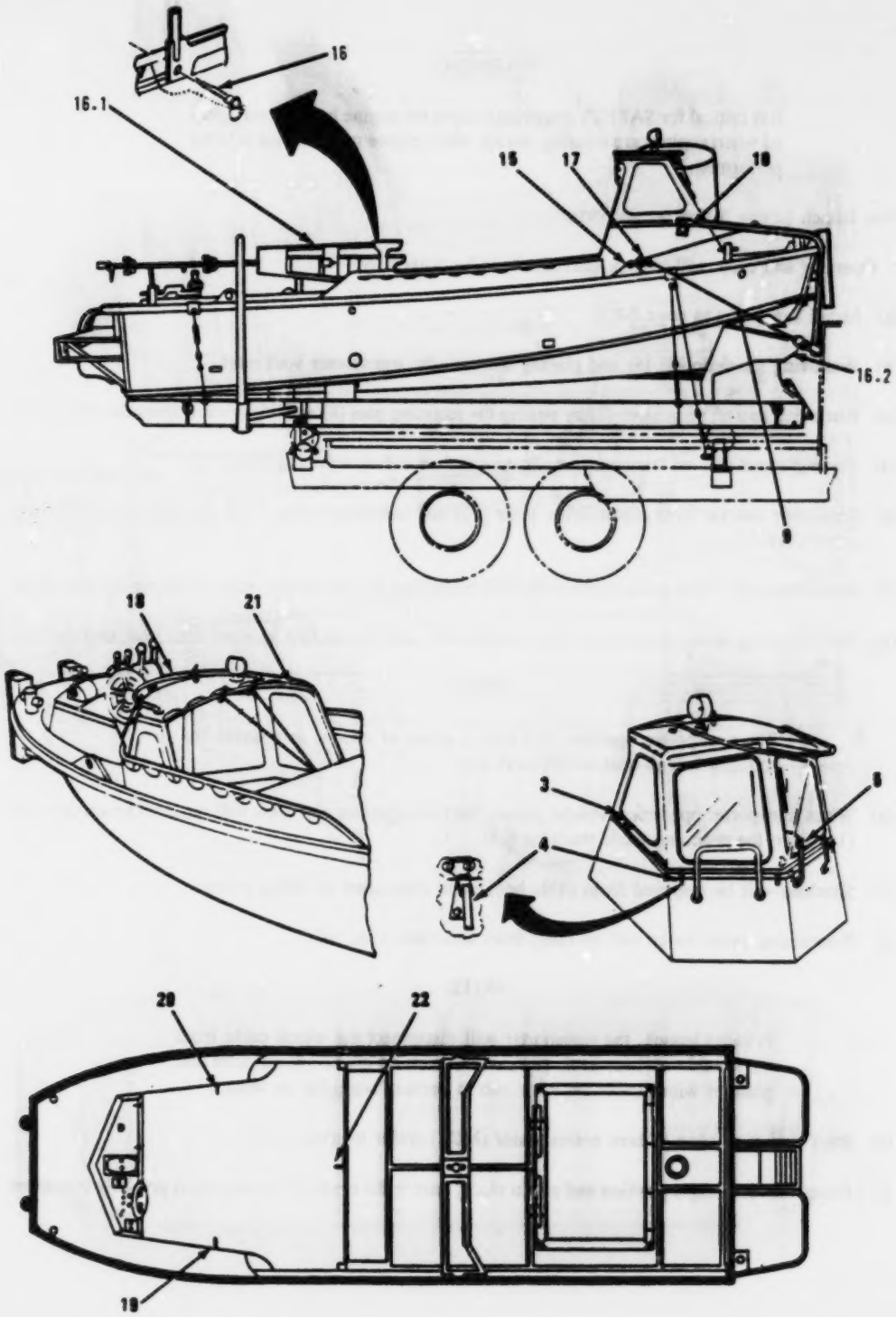
(j) Restraining cable hooks will be hung from stanchion eyes (10).

NOTE

Prior to launch, the transporter will disconnect the winch cable from the shackle on boat keel, put shackle back on cradle lifting point and position winch cable on truck cab to prevent snagging on launch.

(k) Start engine as soon as boat enters water (MK1) (refer to page 2-44).

(l) Raise mast to upright position and pin in place, ensure the electrical connector is properly connected.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16.1
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16.2
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c. Boat retrieval.

(1) During retrieval the following action will be taken:

(a) Remove pin (16) and lower and secure mast (16.1).

(b) Boat operator will guide the boat into saddle (16.2) and push saddle forward keeping boat straight.

(c) Crew will remove cable hooks (17) from stanchion eyes (10) and hook them to shackles (15) at forward boat lift points (one each side of boat).

(d) When restraining cables (9) are hooked up, the boat operator will tension the cables by using scoops in the astern position at idle engine speed.

CAUTION

Do not operate engines with boat out of water. Damage to raw water pump and engine will result. (MK1 only).

(e) As retrieval starts, the boat operator will hold boat centered in the cradle by using engine power and steering controls.

(f) Boat operator will shut down engines as boat clears water.

CAUTION

Scoop control levers must be fully forward or damage to scoops or cradle may result.

(g) After boat is secured on transporter disconnect windshield wiper electrical plug (5) from receptacle at center of control panel.

(h) Release six cab clamp fasteners (4) which secure cab to deck.

(i) Using four cab lifting handles (3) lift cab to clear engine, transmission and scoop controls. Remove cab from boat.

(j) Place cab in forward compartment.

(k) Tie cab from forward handrail (18) to port tiedown eye (19) and starboard tiedown eye (20).

(l) Tie cab from rear handrail (21) to rear tiedown eye (22).

NOTE

Upon retrieval, the bilge plug should be removed to drain water from boat.

2-27. COMING INTO BERTH

CAUTION

Ropes and mooring lines can be sucked into hydrojets. Avoid running over ropes or lines.

NOTE

Use following instructions if port side berthing is planned. For starboard side use opposite controls.

a. Approach berth against current at slight angle to berth.

b. Decrease engine speed to about 1,000 rpm.

c. Pull scoop control levers back toward neutral until boat is moving ahead slowly.

d. Assistant boat operator stands by side of cab holding onto safety rail on top of cab. If cab removed, assistant operator kneels at side of cockpit holding onto safety rail inside cockpit area.

e. Move starboard scoop control lever ahead slightly to swing bow to port.

f. Move both scoop controls toward neutral until boat is moving ahead very slowly.

g. When bow touches move scoop controls to neutral.

h. Assistant boat operator secures line to appropriate tie-up on berth and to bow bollard on berth side of boat.

i. Reduce engine rpm to 750 - 800.

j. Turn steering wheel to starboard to swing stern of boat against berth.

k. Secure line to appropriate tie-up on berth and to stern bollard on berth side of boat.

l. Put transmission control in neutral.

m. Stop engines (refer to page 2-77).

RIBBON BRIDGE RATING CHART

Rating	Velocity (ft/sec)							
	0-3	4	5	6	7	8	9	10
NORMAL (Track / Wheel)	75 / 96	75 / 96	70 / 96	70 / 96	70 / 82	60 / 65	45 / 45	30 / 30
CAUTION (Track / Wheel)	85 / 105	85 / 105	80 / 100	80 / 100	80 / 96	65 / 75	50 / 50	35 / 35
RISK (Track / Wheel)	100 / 110	95 / 110	90 / 105	90 / 105	90 / 100	75 / 82	65 / 65	40 / 40

NOTES:

1. These ratings apply for a bridge held in place with bridge erection boats. In currents up to 6 ft/sec, one boat is required per six bays. In 8 ft/sec, one boat is required every three bays. In 9 ft/sec, one boat is required every two bays. In currents above 9 ft/sec, or if the bridge is to remain in place for long periods of time, bridle lines should be used (150° vertical angle).

2. Vehicle spacing criteria:

Rating	
Normal	100 feet (Front-To-Back)
Caution	150 feet (Front-To-Back)
Risk	One vehicle only on bridge

3. Maximum Speeds for Normal Crossings:

On Ramps	Class 0 to Class 40	- 15 mph
	Over Class 40	- 5 mph
On Bridge	Class 0 to Class 40	- 25 mph
	Over Class 40	- 15 mph

2-28. RETRIEVING A FREE LAUNCHED RIBBON BRIDGE BAY (PUSHER TECHNIQUE)

NOTE

The Bridge transporter operator is responsible for launching Ribbon Bridge Ramp and Interior Bays. (Refer to TM 5-5420-209-12)

NOTE

Retrieving a free launched Ribbon Bay requires at least one boat operator and two assistant boat operators per boat.

a. Boat operator. Position the boat 3 to 5 meters downstream from the Ribbon Bay launching site with the boat facing upstream.

WARNING

Do not allow the bay to open up on top of the bow of the boat. Personnel may be thrown into the water. Severe damage to boat could result.

Hold on to safety rail. You could be thrown overboard when the boat bumps the bay.

b. Boat operator. After the bay is completely open, maneuver the boat until the pushknees are in contact with the downstream side of the bay.

WARNING

Do not get any part of body between bay and boat. Injury to personnel could result.

c. Assistant boat operators. Stand on side of cab, holding onto safety rail on cab top until the pushknees touch the Ribbon Bay. Stand well aft of the operator's forward field of vision. If cab is removed, assistant operators will kneel at side of cockpit and hold onto safety rails inside cockpit area until pushknees touch Ribbon Bay.

WARNING

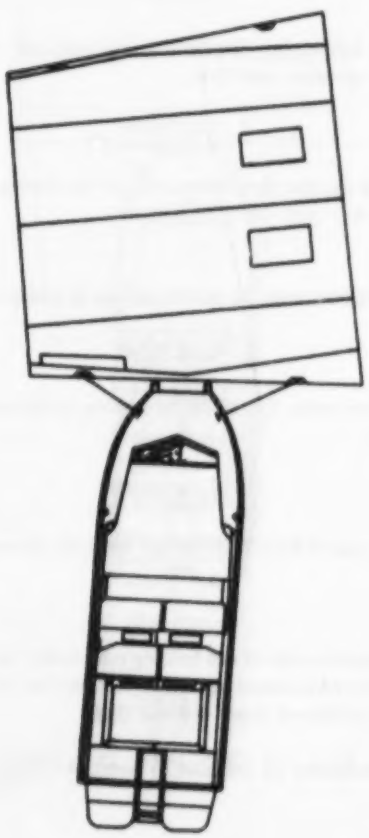
Minimize boat maneuvering against bay until all roadway connectors are in place. Personnel injury could result.

d. Boat operator. Keep the pushknees of the boat in constant contact with the Ribbon bay. Use enough power to prevent the bay from pushing the boat downstream or into shallow water.

CAUTION

Make sure that each tieline is tight and the bay is held firmly against the pushknees or the bay will tend to pull off to the side of the boat.

e. Assistant boat operators. Secure one tieline to each of the anchoring pins on the downstream side of the bow ponton of the Ribbon Bay. Pull each tieline tight and secure it to the bow bollard on its respective side of the boat.



WARNING

Minimize boat maneuvering against bay until all roadway connectors are in place. Personnel injury could result.

WARNING

Do not step, kneel, or lay down over the joint between roadway pontons.

f. Assistant boat operators. Secure all roadway to roadway ponton connectors and roadway ponton to bow ponton connectors. Rotate travel latches down. Raise the hand rails. (Refer to TM 5-5420-209-12.)

g. Boat operator. Manuever bay into position for raft or bridge contruction.

h. Assistant boat operators. Stand by to assist in raft or bridge contruction.

2-29. RECOVERY OF RIBBON BRIDGE BAY (PUSHER TECHNIQUE)

NOTE

Recovery of a Ribbon Bay requires at least one boat operator and two assistant boat operators per boat.

CAUTION

Be sure to keep the boat downstream of the bay during recovery operations. Ribbon Bay may drift downstream.

a. Boat operator. Maneuver the boat until the pushknees are in contact with the downstream side of the bay.

WARNING

Hold on to safety rails. You could be thrown overboard when the boat bumps the bay.

WARNING

Do not get any part of body between bay and boat. Personnel injury could result.

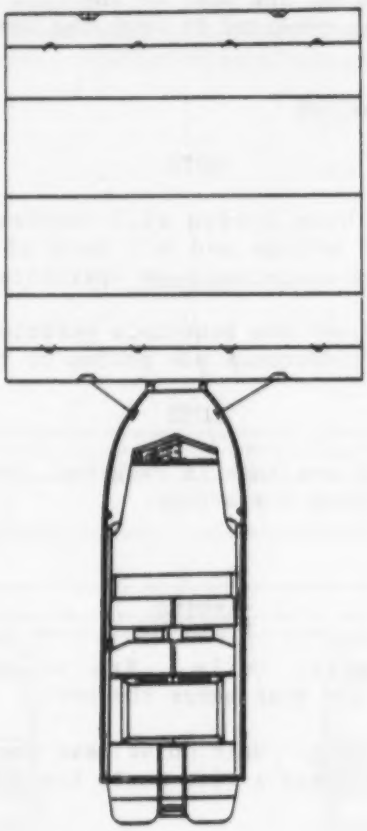
b. Assistant boat operators. Stand on side of cab holding onto safety rail on top of cab until pushknees contact the Ribbon Bay. If cab is removed assistant operators will kneel at side of cockpit and hold onto safety rails inside of cockpit area until pushknees touch Ribbon Bay.

c. Boat operator. Keep the pushknees of the boat in constant contact with the Ribbon Bay.

CAUTION

Make sure that each tieline is tight and the bay is held firmly against the pushknees or the bay will tend to pull off to the side of the boat.

d. Assistant boat operators. Secure one tieline to each of the anchoring pins on the downstream bow ponton of the Ribbon Bay. Pull each tieline tight and secure it to the bow bollard on its respective side of the boat.



WARNING

Do not step, kneel, or lay down on the joint between roadway pontons.

e. Boat operator. Maneuver the Ribbon Bay to recovery site. Place the Ribbon Bay close enough to the transporter so that the assistant boat operator can hook the winch cable hook onto the bay lifting eye. The centerline of the bay should be in line with the transporter.

f. Assistant boat operators. Lower hand rails. Rotate travel latches down. Rotate all fold lock latches up. Open all roadway to bow ponton latches. Rotate both roadway to roadway connectors.

g. Assistant boat operators. Hook the winch cable hook to the bay lifting eye with the open end of the hook facing the bay. Remove the tielines from the bay and stow them on the boat. Remain on boat.

h. Boat operator. Maneuver the boat to the rear downstream bow ponton and push on the ponton as required to keep the bay in line with the transporter.

2-30. ANCHORING A RIBBON BRIDGE

NOTE

Anchoring a Ribbon Bridge will require one boat for each 3 bays of bridge and not less than one boat operator and two assistant boat operators per boat.

a. Boat operator. Maneuver the boat into position until the pushknees are in contact with the downstream bow ponton of the bridge.

NOTE

When more than one boat is required, boats should be evenly spaced along the bridge.

WARNING

Hold on to safety rails. You could be thrown overboard when the boat bumps the bay.

b. Assistant boat operators. Wait on or near the bow of the boat without blocking the boat operator's view until the pushknees touch the bridge.

c. Boat operator. Keep the pushknees of the boat in constant contact with the bridge.

WARNING

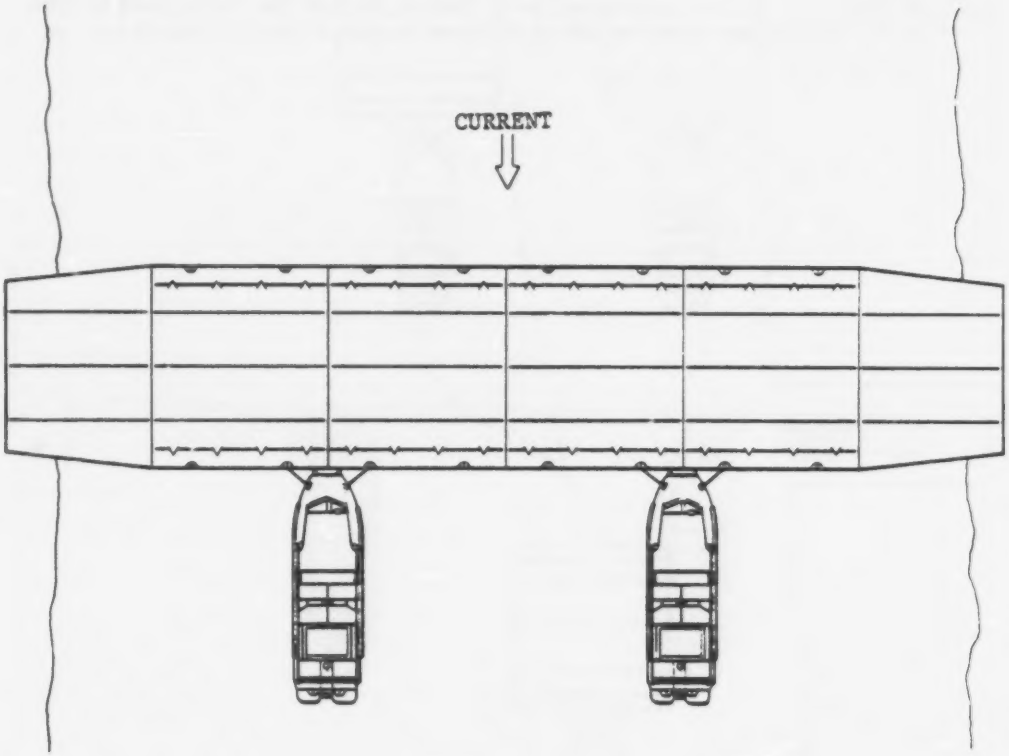
Do not get any part of body between bay and boat. Injury to personnel could result.

WARNING

Make sure that each tieline is tight and the bay is held firmly against the pushknees or the bridge will tend to pull off to the side of the boat.

d. Assistant boat operators. Secure one tieline to the nearest bow ponton anchoring pin on the bridge to port and starboard of the boat. Pull each tieline tight and secure it to the bow bollard on its respective side of the boat.

e. Boat operator. Maintain bridge on centerline by adjusting the scoop controls and throttles. Follow directions of the bridge commander.



2-31A RAFTING ASSEMBLY

CAUTION

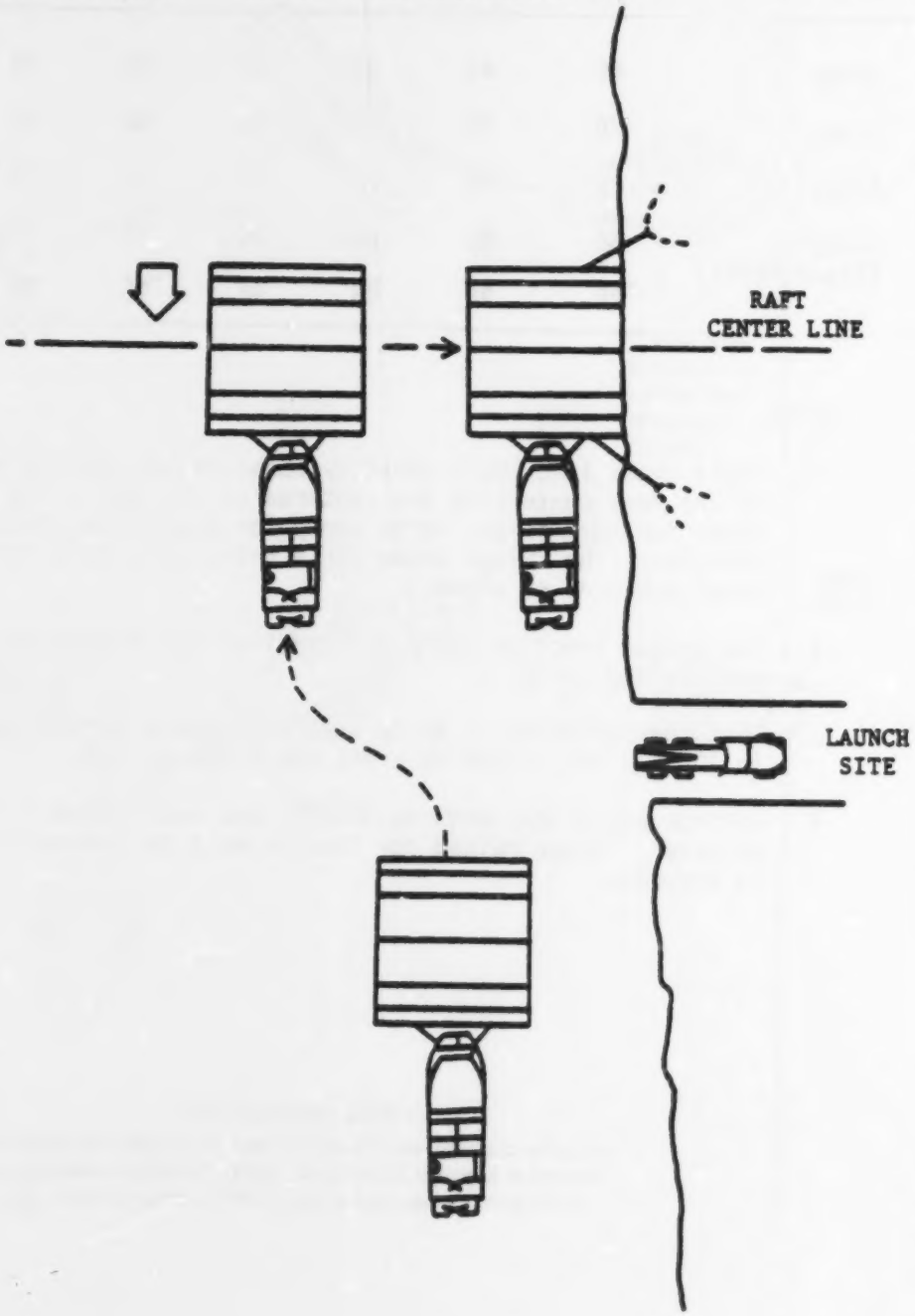
Rafting in debris-laden streams is extremely dangerous because floating logs, trees, brush, and ice may puncture and sink pontons and boats and foul boat hydrojet intakes and jets.

NOTE

Not less than two boats are required for rafting. Each boat will require one boat operator and at least two assistant boat operators.

a. Boat operator. After launched bay has been retrieved in accordance with retrieving operations (see page 2-92) maneuver the Ribbon Bay into position on the raft centerline and within boat hook length of the bay to be connected to. Maintain bay on raft centerline until assistant boat operators have secured bay to bay/bays on centerline.

b. Assistant boat operators. Prepare bays for joining on raft. When boat operator has bay in position, pass lines or boat hooks across gap and pull bays together. Connect bay to bays on raft centerline by closing deck connectors and tightening lower lock drives by turning them clockwise with T-wrench until lower lock drive seats all the way. Secure bank side bay to the bank with at least 2 approach guys. (Refer to TM 5-5420-209-12.)

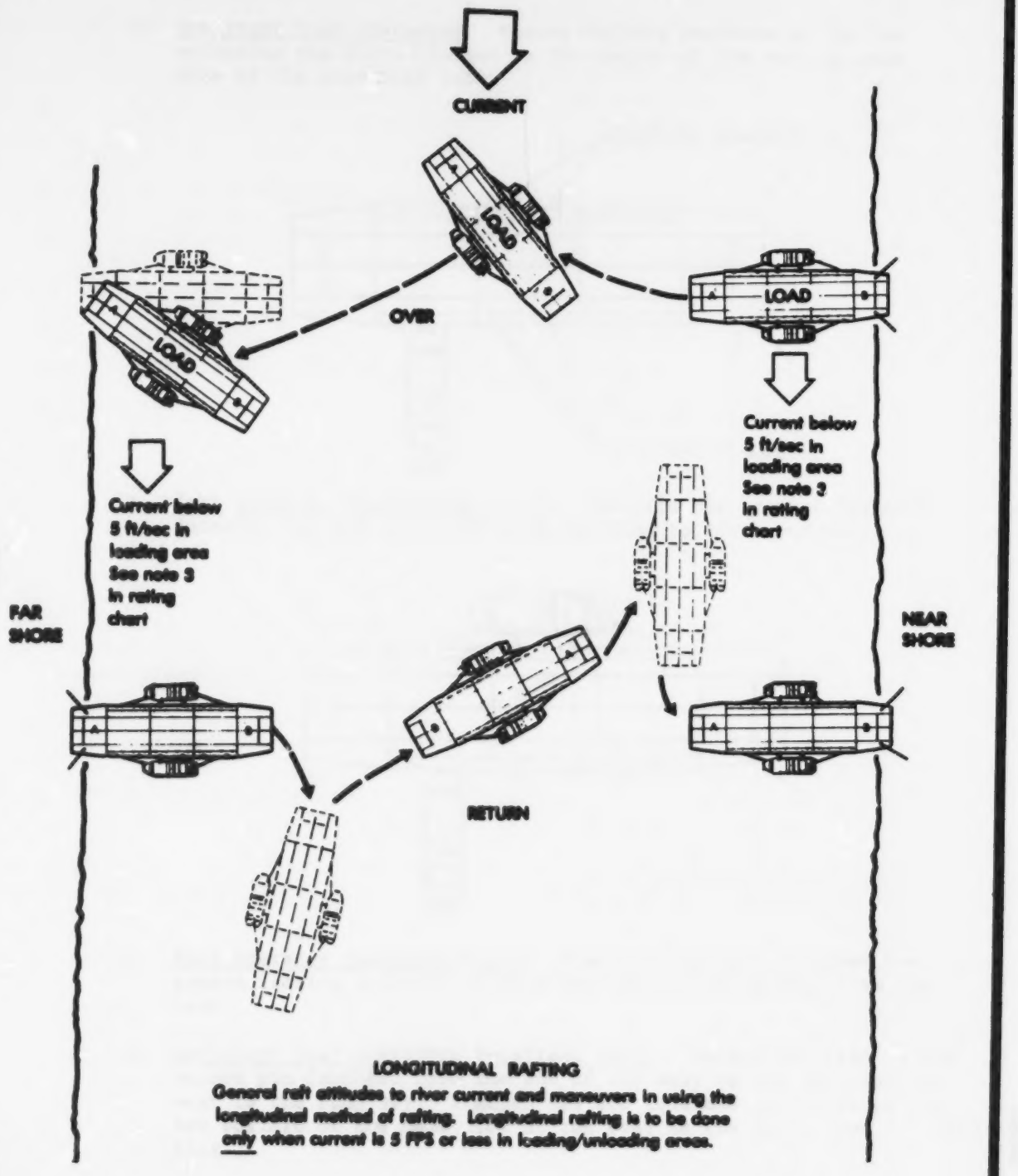


LONGITUDINAL RAFT RATING CHART

Raft Size	Raft Velocity (ft/sec)							
	0-3	4	5	6	7	8	9	10
3-bay	45	45	45	40	40	35	30	25
4-bay	70	70	70	60	60	60	55	45
5-bay	75	75	75	70	70	70	60	60
6-bay (Track Wheel)	80	80	80	70	70	70	70	70
	96	96	96	96	96	96	70	70

NOTES:

1. Table shows load (MLC) capacity based on one vehicle positioned on the raft centerline and centered on the deck. The values shown for 3-/4-/5-bay rafts apply for wheeled or tracked vehicles. The values shown for a 6-bay raft apply for track/wheel vehicles as shown.
2. Two bridge erection boats are required for propulsion with any raft in the table.
3. This configuration is to be used only where current velocities in loading and unloading areas are 5 fps or less.
4. Ratings apply only with bottom of ramp ends raised 1 foot clear of water. Ramps raised for loading must be lowered before raft is underway.

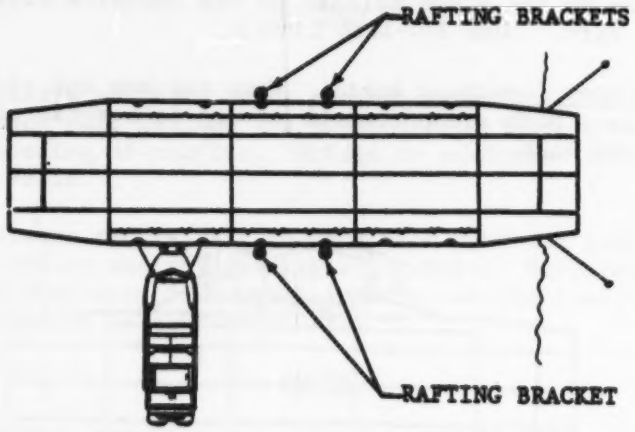


LONGITUDINAL RAFTING

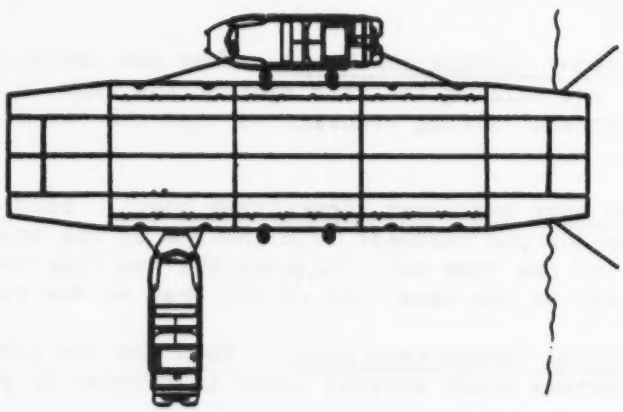
General raft attitudes to river current and maneuvers in using the longitudinal method of rafting. Longitudinal rafting is to be done only when current is 5 FPS or less in loading/unloading areas.

2-31B RAFTING-LONGITUDINAL METHOD

a. Assistant boat operators. Secure rafting brackets in the two anchoring pin slots closest to the center of the raft on each side of the assembled raft.



b. Boat operator (downstream boat). Position bow against outboard interior bay and hold raft perpendicular to river current.



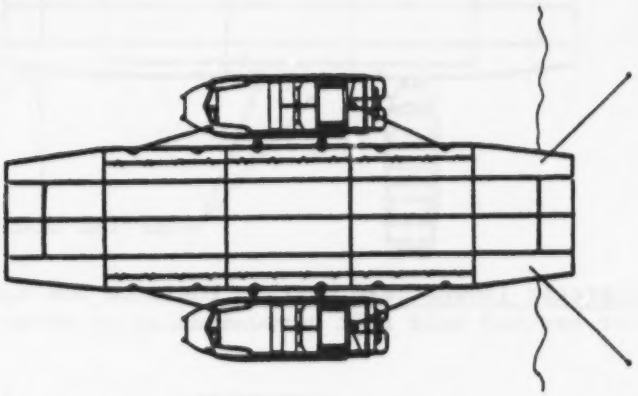
c. Boat operator (upstream boat). Ease boat against upstream bow ponton rafting brackets so that the bow is facing away from the bank.

d. Assistant bout operators (upstream boat). Secure bow line to the anchor pin farthest from the bow of the boat on the interior bay next to the ramp bay. Tighten the bow line and secure it to the bow bollard on the same side of the boat as the raft. (Use 3/4-inch line.)

e. Boat operator (upstream boat). When line is secured, put all controls in neutral.

f. Assistant boat operators (upstream boat). Secure stern line to the bridge anchor pin farthest from the stern of the boat on the interior bay next to the ramp bay. Pull the stern line tight and wrap it twice around the capstan. Crank the capstan until all slack is out of the stern and bow lines. Secure free end of the stern line to the stern bollard on the opposite side of the boat from the raft. (Use 3/4-inch line.)

g. Boat operator (upstream boat). When the bow and stern lines are tight, place both scoop control levers in reverse to hold the raft against the bank.



h. Boat operator (downstream boat). When the upstream boat is secured in place and holding the raft against the bank, pivot the boat against the downstream rafting brackets so that the bow is facing away from the bank.

i. Assistant boat operators (downstream boat). Secure bow line to the bridge anchor pin farthest from the bow of the boat on the interior bay next to the ramp bay. Tighten the bow line and secure it to the bow bollard on the same side of the boat as the raft.

j. Boat operator (downstream boat). When the bow line is secured, put the downstream scoop control lever in reverse to pull the bow line tight.

k. Assistant boat operators (downstream boat). Secure stern line to the bridge anchor pin farthest from the stern of the boat on the interior bay next to the ramp bay. Pull the stern line tight and wrap it twice around the capstan. Crank the capstan until all slack is out of the stern and bow lines. Secure free end of the stern line to the stern bollard on the opposite side of the boat from the raft.

l. Boat operator (downstream boat). When the bow and stern lines are tight, place both scoop control levers in forward, turn helm into the current and idle to help hold the raft against the bank.

m. Assistant boat operators (both boats). Operate ramp pumps and approach ramps. Secure and cast off approach guys. Check traffic. Check and tighten bow and stern lines as needed.

n. Boat operators (both boats). Maneuver boats in accordance with signals from raft commander.

CAUTION

Always position scoop control levers so that boats push raft against the shore during loading and off loading of traffic. Bridge or equipment damage could result.

Always secure raft to bank with approach guys during loading and off loading of traffic. Raft could be pushed away from shore causing vehicle loading/off loading to dump into water.

NOTES

Rafts operating in a river crossing with more than one raft using same loading and unloading sites will follow a figure eight traffic pattern.

CONVENTIONAL RAFT RATING CHART

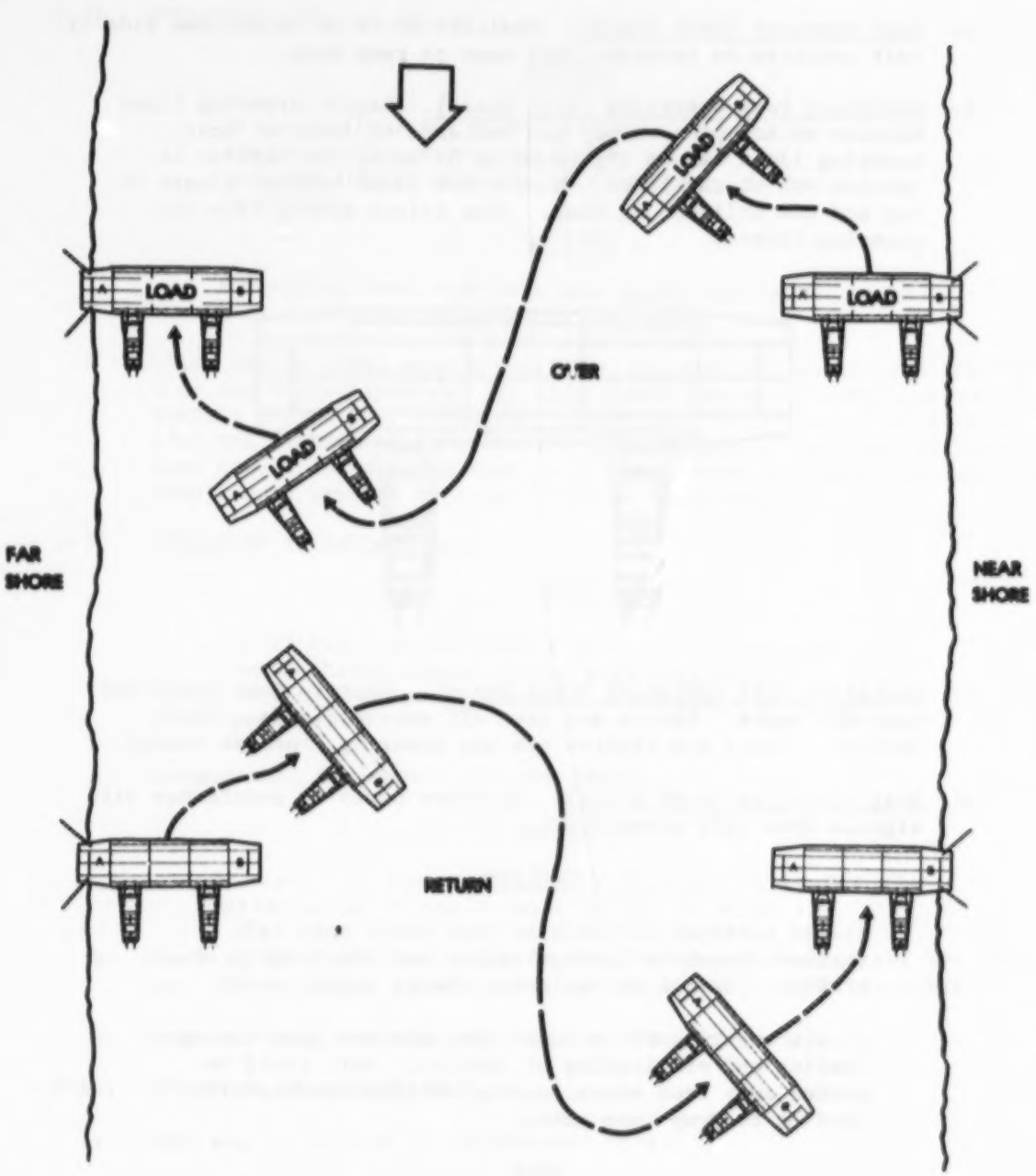
Raft Size	Raft Velocity (ft/sec)							
	0-3	4	5	6	7	8	9	10
3-bay	45	45	35	25	15	10	0	0
4-bay	60	60	60	55	40	30	15	0
5-bay	75	70	70	70	60	50	25	0
6-bay (Track Wheel)	75	70	70	70	70	55	30	0
	96	96	96	70	70	55	30	0

NOTES:

1. Table shows load (MLC) capacity based on one vehicle positioned on the raft centerline and centered on the deck. The values shown for 3-/4-/5-bay rafts apply for wheeled or tracked vehicles. The values shown for a 6-bay raft apply for track/wheel vehicles as shown.

2. Ratings apply only with bottom of ramp ends just clear of water. Ramps raised for loading must be lowered before raft is underway.

3. Raft commander must observe leading edge of raft and decrease speed or halt operations as necessary if water coming over bow exceeds 1 inch.



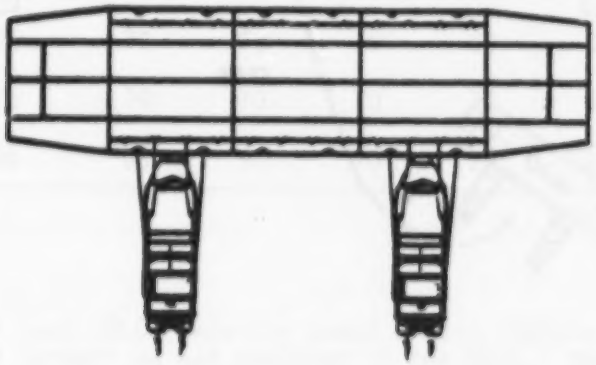
CONVENTIONAL RAFTING

General raft attitudes to river current and maneuvers in using the conventional method of rafting.

2-31C. RAFTING - CONVENTIONAL METHOD

a. Boat operator (both boats). Position boats on downstream side of raft centered on interior bays next to ramp bays.

b. Assistant boat operators (both boats). Secure steering lines between anchor pins on bay and bollards at stern of boat. Steering lines can be tightened up by using the capstan to tension one of the lines. Secure bow lines between cleats on bay and bow bollards on boat. (Use 1-inch manila line for steering lines.)



c. Assistant boat operators (both boats). Operate ramp pumps and approach ramps. Secure and cast off approach guys. Check traffic. Check and tighten bow and steering lines as needed.

d. Boat operators (both boats). Maneuver boats in accordance with signals from raft commander.

CAUTION

Always position controls so that boats push raft against the shore during loading and off-loading of traffic. Bridge or equipment damage could result.

Always secure raft to bank with approach guys during loading and off-loading of traffic. Raft could be pushed away from shore causing vehicle loading/off-loading to dump into water.

NOTE

Rafts operating in a river crossing with more than one raft using the same loading and unloading sites will follow a figure eight traffic pattern.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-32. OPERATION WITH ONE ENGINE

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

CAUTION

Exceeding 2000 rpm with one engine running makes the boat difficult to maneuver.

There may be times when you will be required to operate the boat with only one engine running. If this should happen, do not operate the running engine over 2000 rpm. Adjustments will have to be made in your steering procedures to allow for the tendency of the boat to turn. Upon completion of your task or mission, head for shore and immediately report your problem to organizational maintenance.

2-33. OPERATION IN EXTREME COLD

WARNING

It is critical for SAFETY purposes to keep the engine hatch covers closed when engines are running, except when engine maintenance is being performed.

a. Inspect hull frequently for ice damage.

CAUTION

Do not run the engines in neutral to charge the batteries as it could cause valves to stick.

b. Check bilge pumps frequently to see that pumps and outlets are free of ice. If necessary, use hot air or hot water to thaw the pumps.

c. Operate scoop controls and steering wheel frequently.

2-34. OPERATION IN EXTREME HEAT

a. Keep engine coolant at recommended level.

b. Do not fill the fuel tank above full mark on dipstick. Allow room for expansion of fuel.

2-35. OPERATION IN SALT WATER

a. Always keep hatch covers closed.

b. If available, wash down engines and engine accessories with fresh water. Wipe dry the exteriors of engines and engine accessories after each operation.

c. Keep engine and hydrojet compartments as dry as possible.

d. Check hull frequently for signs of corrosion. Corrosion is likely to occur at exhaust, vent, and drain openings, and areas subject to wear. Signs of corrosion and bare spots on painted surfaces should be taken care of as soon as possible.

e. Frequently inspect the lights, bilge pumps, fire extinguishers, electrical connections, and lines for signs of corrosion or salt accumulation. Wipe items frequently.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

For safer, more trouble-free operation, see to it that your boat is serviced when it needs it. For the proper lubricant and service intervals, see LO 5-1940-277-12.

Section II. TROUBLESHOOTING PROCEDURES

The table lists the common malfunctions which you may find during the operation or maintenance of the boat or its components. You should perform the tests/inspections and corrective actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or if one listed is not corrected by the given corrective actions, notify your supervisor.

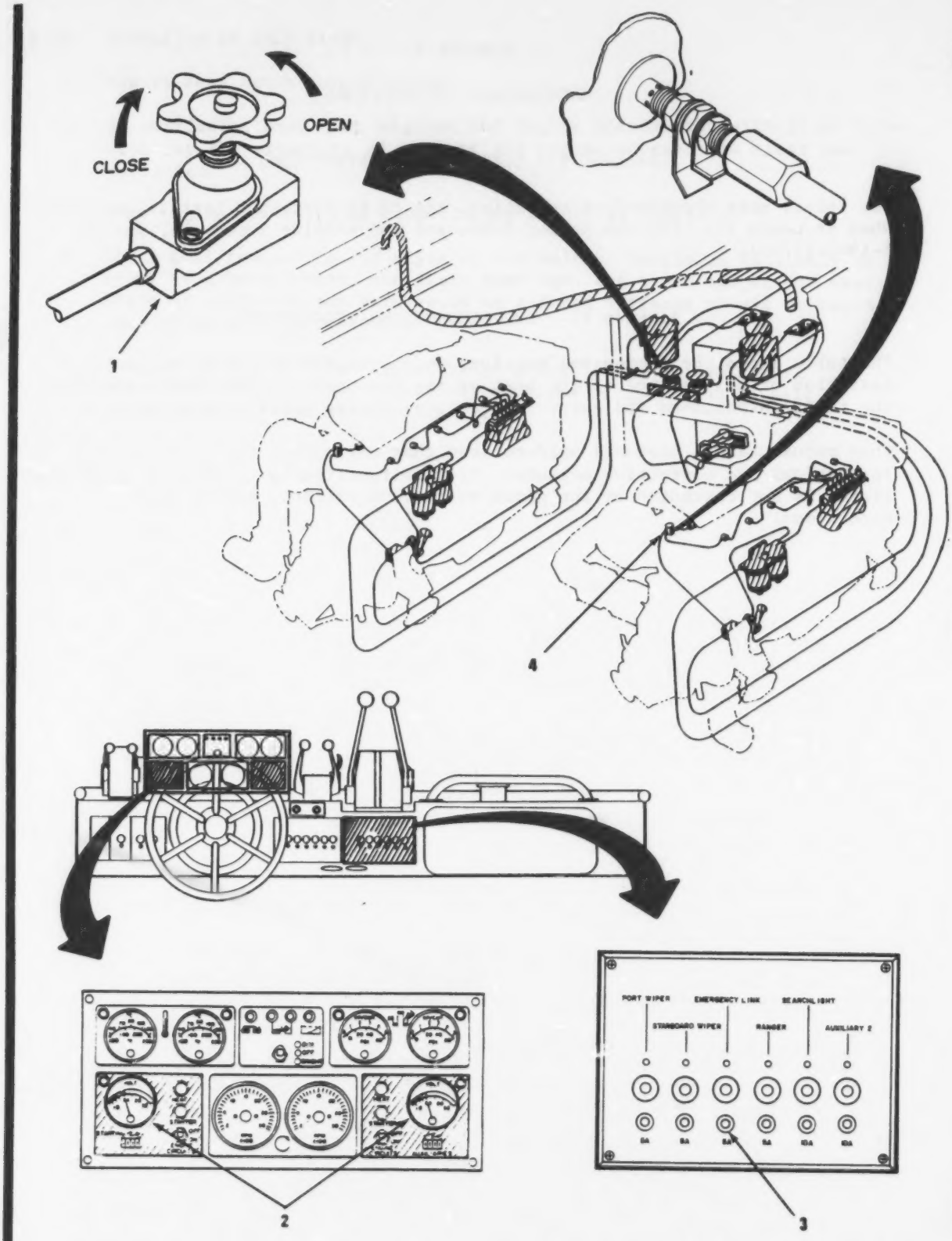

CLOSE
OPEN
1
4
2
PORT WIPER
EMERGENCY LINK
SEARCHLIGHT
STARBOARD WIPER
RANGER
AUXILIARY 2
3

Table 3-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. ENGINE FAILS TO START, STARTS WITH DIFFICULTY AND RUNS BADLY.	
Step 1. Check to see if there is fuel in the fuel tank (see page 2-24).	Add fuel.
Step 2. Check to see that fuel valves (1) are open.	Open valves by turning counterclockwise.
Step 3. Check to see if there is water in fuel water separators (see page 2-26).	Notify organizational maintenance.
Step 4. Check to see if fuel system is functioning normally by holding one of the injector tubes between thumb and forefinger and feeling for a pulsing when engine is turned over by starter.	Notify organizational maintenance.
Step 5. Check to see if reading on battery condition meter (2) is 24.0 vdc or less when engine circuit switch is turned to ON.	Notify organizational maintenance.
Step 6. Check to see if reading on battery condition meter (2) is more than 24.0 vdc but less than 25.4 vdc.	Use emergency link. Press emergency link switch (3) to parallel batteries. Restart engines. Release emergency link switch (3).
Step 7. Check to see if thermostarter (4) is working by holding the hexagon portion of the unit and feeling for a warming when heat switch is pressed.	Notify organizational maintenance.

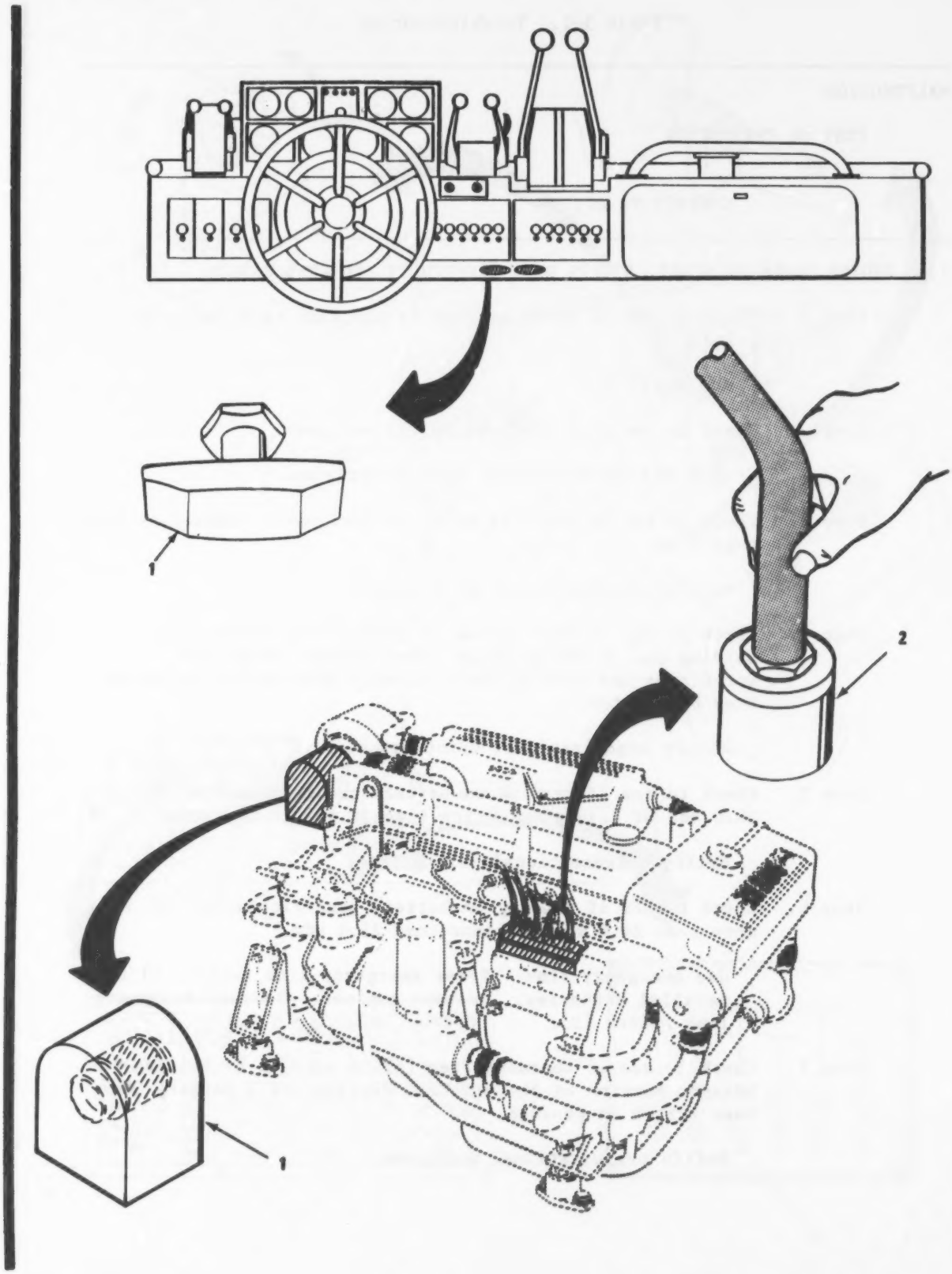

1
2
1

Table 3-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
2. SUDDEN LOSS OF POWER (NO BLACK SMOKE).	
Step 1. Check to see if engine stop control (1) is pushed all the way in.	Push in control.
Step 2. Check to see if fuel system is functioning normally by holding one of the injector tubes (2) between thumb and forefinger and feeling for a pulsing.	Notify organizational maintenance.
Step 3. Check fuel water separators for water in fuel (see page 2-26).	Notify organizational maintenance.
3. SUDDEN LOSS OF POWER (HEAVY BLACK SMOKE).	
Step 1. Look to see if air inlet (1) is blocked.	Notify organizational maintenance.

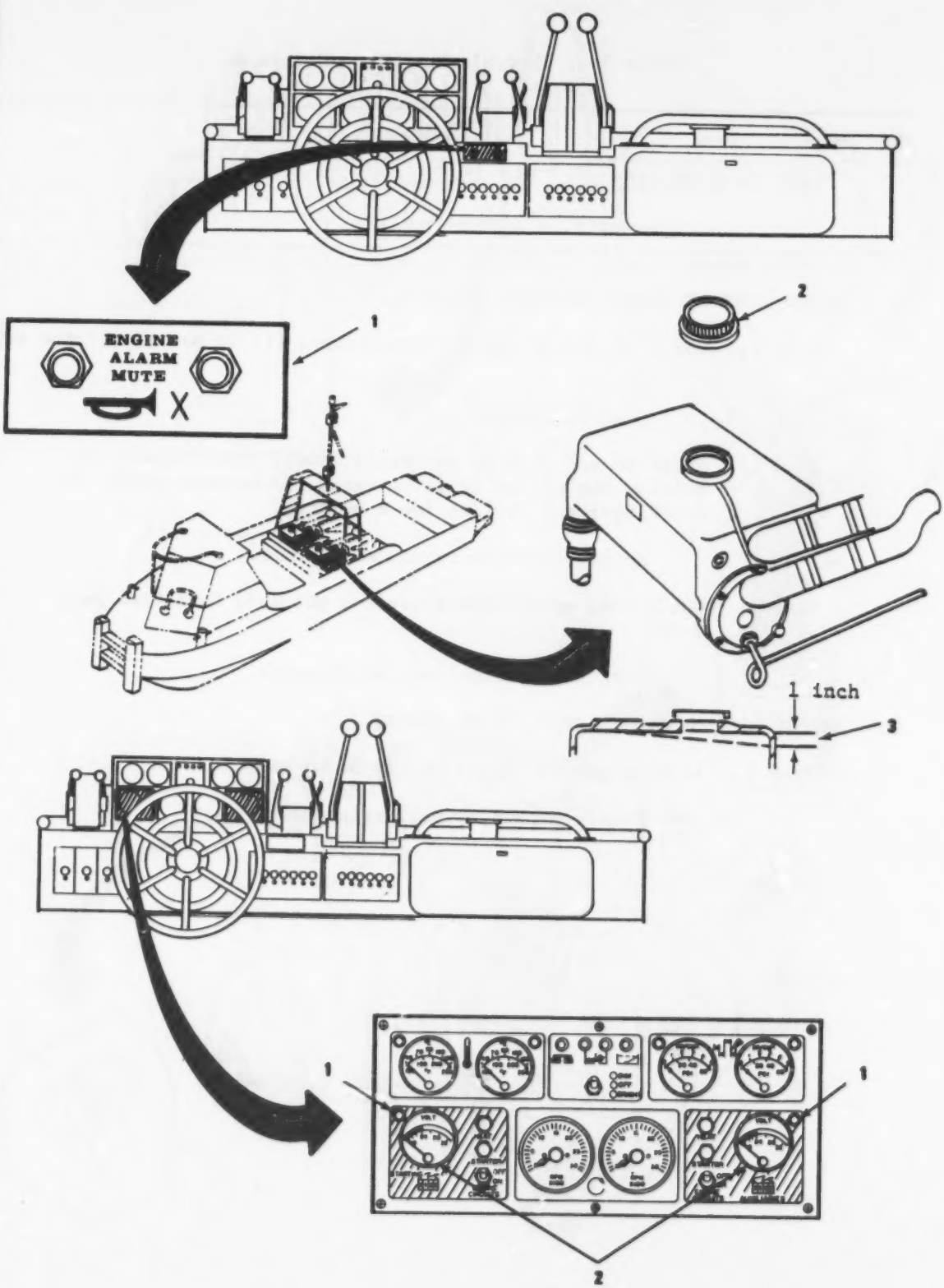

ENGINE
ALARM
MUTE
X
1
2
1 inch
3
1
1
2

Table 3-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
4. OVERHEATING (ENGINE AUDIBLE ALARMS WILL COME ON) (ENGINE COOLANT WARNING LIGHT COMES ON).	
Step 1. Turn OFF alarm mute switch (1) to turn off audible alarms.	
Step 2. Check raw water strainer on the MK1. (See PMCS, item 21.) Check keel coolers on the MK2. (See PMCS, item 1.1.)	Clean.
Step 3. Check for leaks around hose connections and water pumps.	Notify organizational maintenance.
Step 4. Check tension in belt (see page 3-19).	Adjust belt tension.
WARNING If cooling system is hot, open coolant filler cap slowly until all pressure is gone. Do not touch the cap with your bare hand. Never take off cap while engine is overheated. Allow it to cool down first.	
Step 5. Remove filler cap (2) by turning clockwise. Check to see that water level is not more than 1 inch below bottom of neck (3).	Add coolant.
5. CHARGE WARNING LIGHT (1) COMES ON (NORMAL OPERATION).	
Step 1. Check appropriate instrument panel voltmeter (2) for reading at alternator output. If output reading is 24 vdc or above the warning light is malfunctioning. If reading is C vdc or slightly above the alternator or voltage regulator is malfunctioning.	Mission may be completed. Organizational maintenance must be notified or problem.

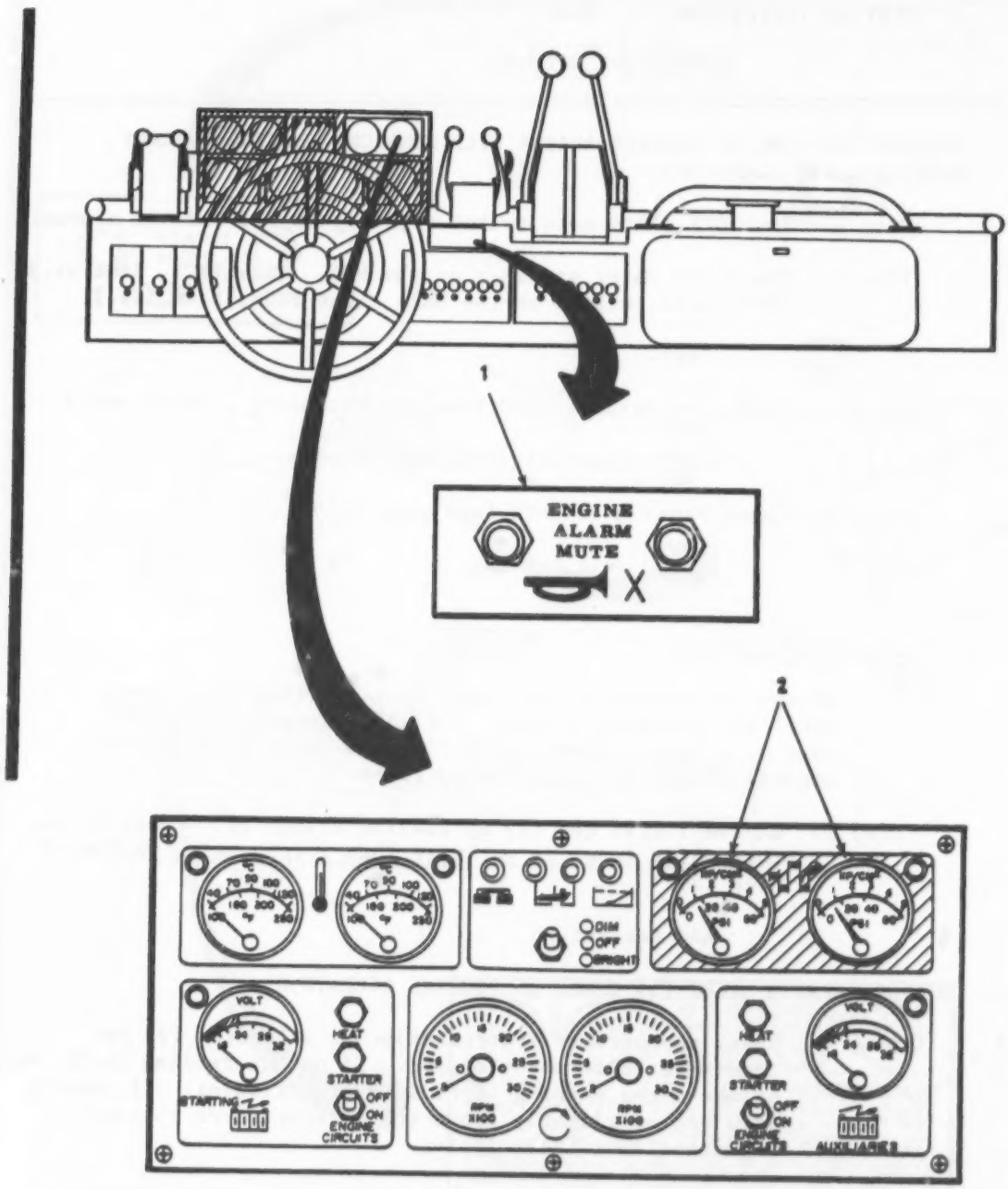

1
ENGINE
ALARM
MUTE
X
2
VOLT
HEAT
STARTER
OFF
ON
ENGINE
CIRCUITS
STARTING
RPM
X100
DIM
OFF
BRIGHT
AUXILIARIES

Table 3-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. LOW OIL PRESSURE (ENGINE AUDIBLE ALARMS WILL COME ON) (OIL WARNING LIGHT COMES ON) (NORMAL OPERATION)

Step 1. Turn OFF alarm mute switch (1) to turn off audible alarm.

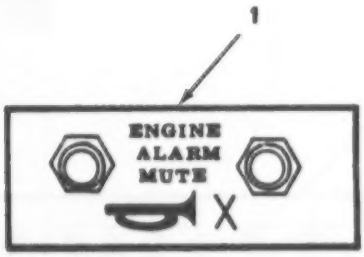
Step 2. Check oil pressure gage (2) for pressure reading of 20 psi (1.5 Kp/cm^2) or above.

If not, reduce engine speed to idle (650 - 750 rpm) for one minute and stop engine (see page 2-77).

Step 3. Check engine oil level (see page 2-31).

Fill to proper level (see page 2-31).

Step 4. Notify organizational maintenance.



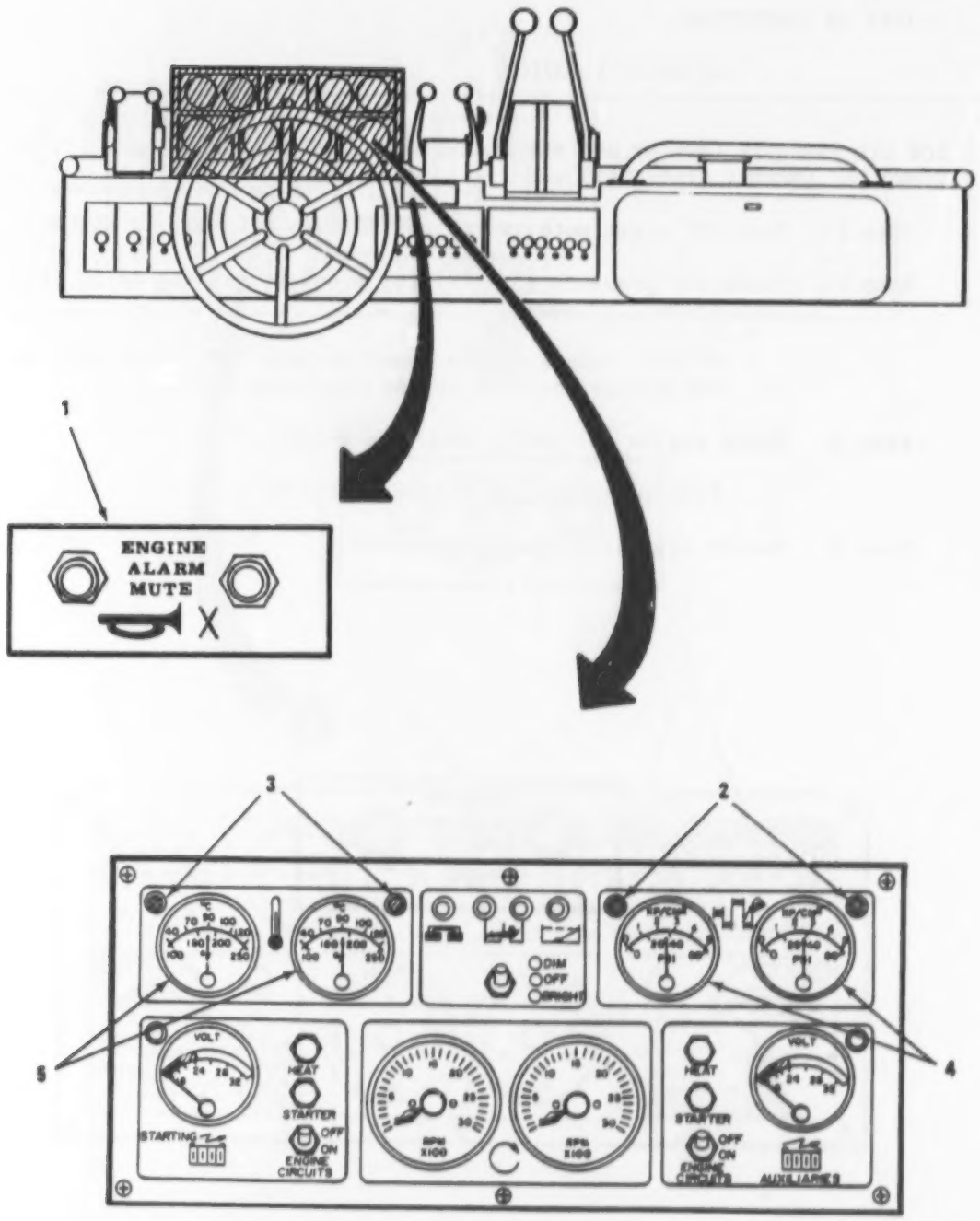

1
ENGINE
ALARM
MUTE
X
2
3
4
5
DIM
OFF
BRIGHT
VOLT
HEAT
STARTER
OFF
ON
ENGINE CIRCUITS
STARTING
AUXILIARIES
RPM X100

Table 3-1. Troubleshooting - Continued

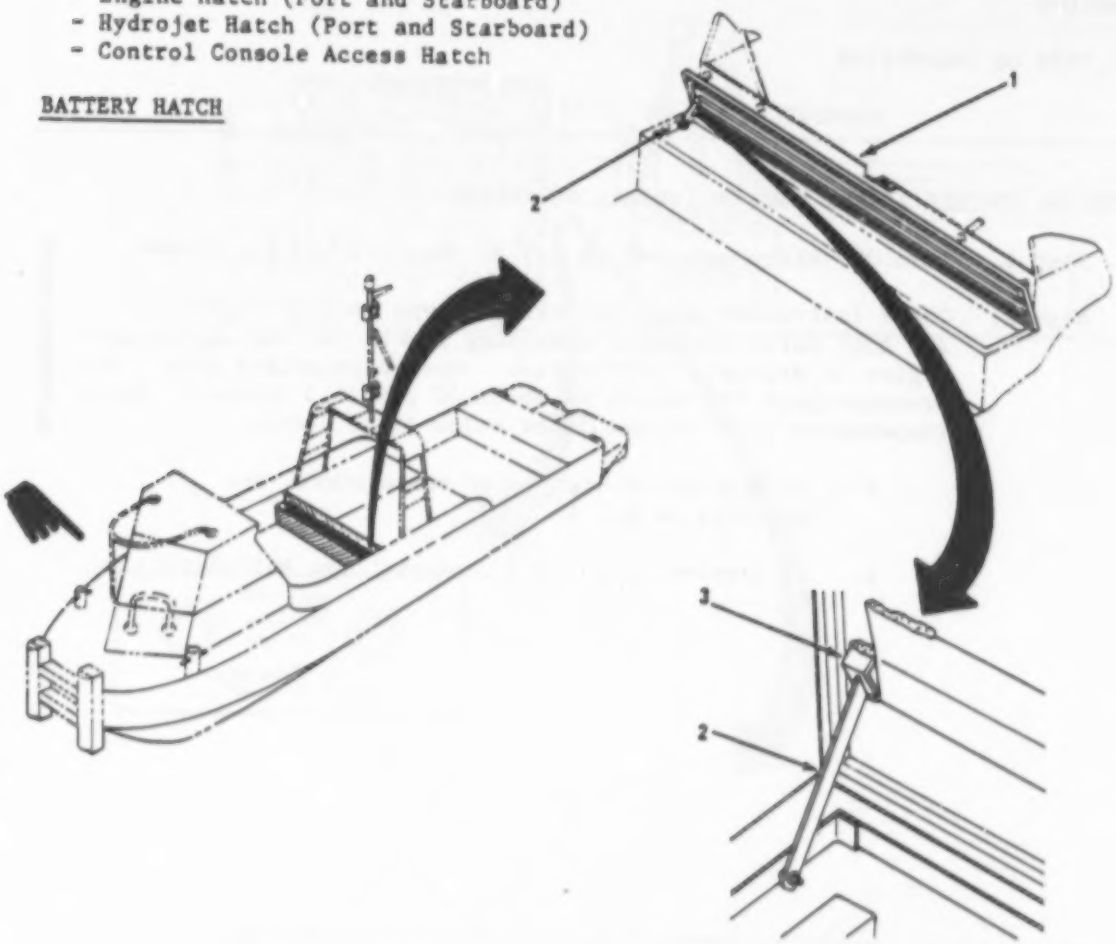
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
7. ENGINE AUDIBLE ALARMS COME ON (NORMAL OPERATION)
Step 1. Turn OFF alarm mute switch (1) to turn off audible alarms.
Step 2. Check instrument panel low oil pressure warning lights (2) and high water temperature warning lights (3) for appropriate engine to determine malfunction. Read appropriate gage. Oil pressure gage (4) should be above 20 psi (1.5 Kp/cm^2). Water temperature gage (5) should be below 194^{o}F (90^{o}C).
a. If problem is high water temperature, see Malfunction No. 4.
b. If problem is low oil pressure, see Malfunction No. 6.

Section III. MAINTENANCE PROCEDURES

ACCESS HATCHES OPENING AND SECURING INSTRUCTIONS

- Battery Hatch
- Engine Hatch (Port and Starboard)
- Hydrojet Hatch (Port and Starboard)
- Control Console Access Hatch

BATTERY HATCH



Opening and Securing:

1. Lift up front edge of battery hatch (1).
2. Swing securing brace (2) into grooved slot (3) on hatch (located on starboard side).

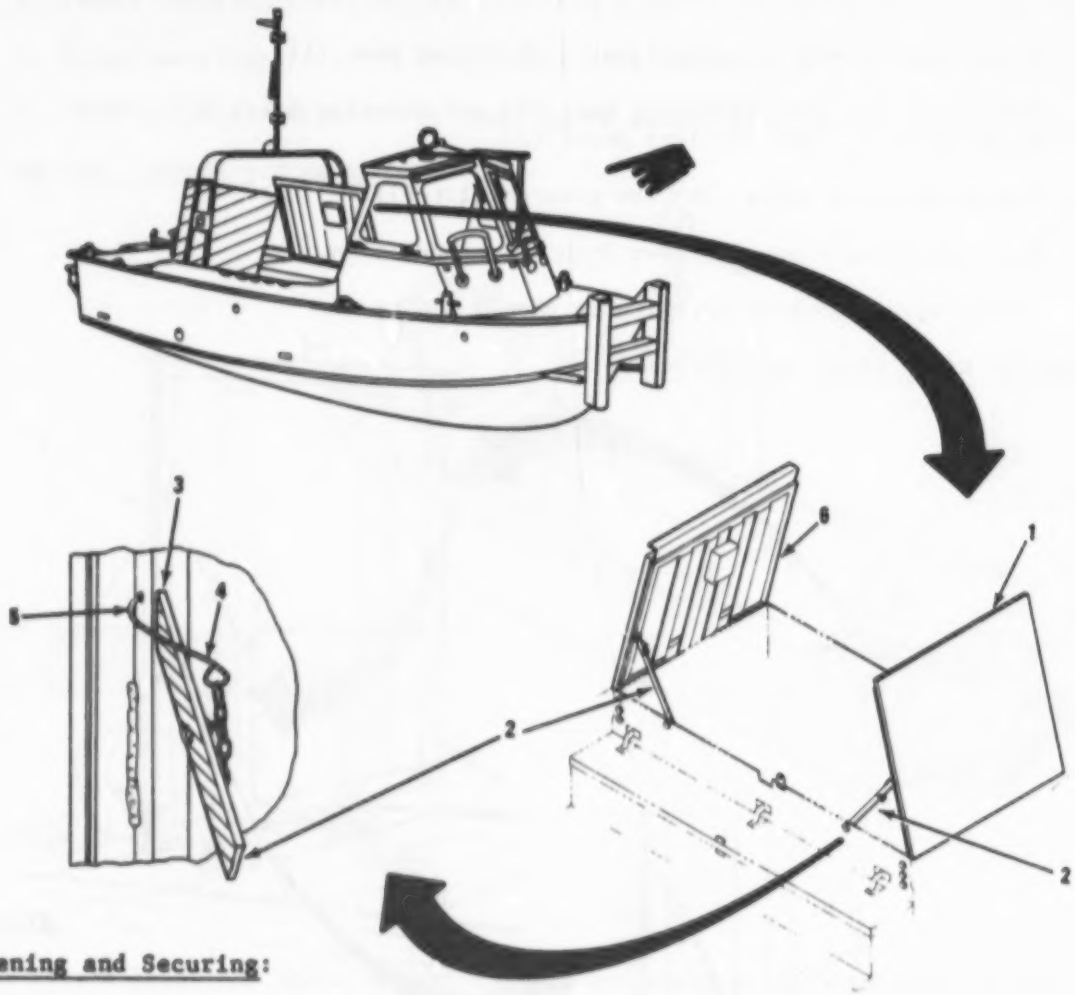
Closing:

1. Grasp front edge of battery hatch (1) and lift to open position to clear brace (2).

2. Remove securing brace (2) from grooved slot (3) and lower into stored position.

3. Close battery hatch by lowering to closed position.

ENGINE HATCHES (Port and Starboard)



Opening and Securing:

1. Open port engine hatch (1).

2. Swing securing brace (2) upward into grooved slot (3) on hatch.

3. Place pin (4) through retaining bolt (5).

4. Open starboard engine hatch (6).

5. Swing securing brace (2) upward into grooved slot (3) on hatch.

6. Place pin (4) thru retaining bolt (5).

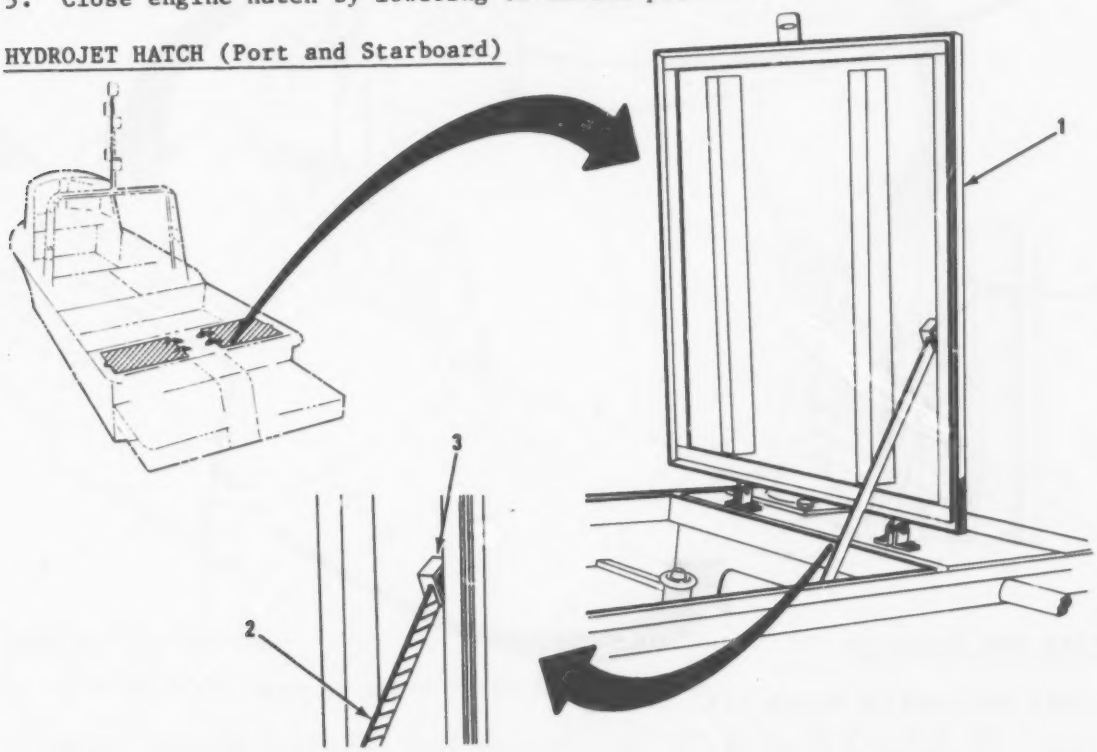
NOTE

When both engine hatches are open the starboard hatch must be closed first.

Closing:

1. Grasp edge of engine hatch [starboard (6) or port (1)].
2. Remove pin (4) from retaining bolt (5) and securing brace (2). Push hatch (6 or 1) open to clear brace (2).
3. Remove securing brace (2) from grooved slot (3).
4. Swing securing brace (2) down into stored position.
5. Close engine hatch by lowering to closed position.

HYDROJET HATCH (Port and Starboard)



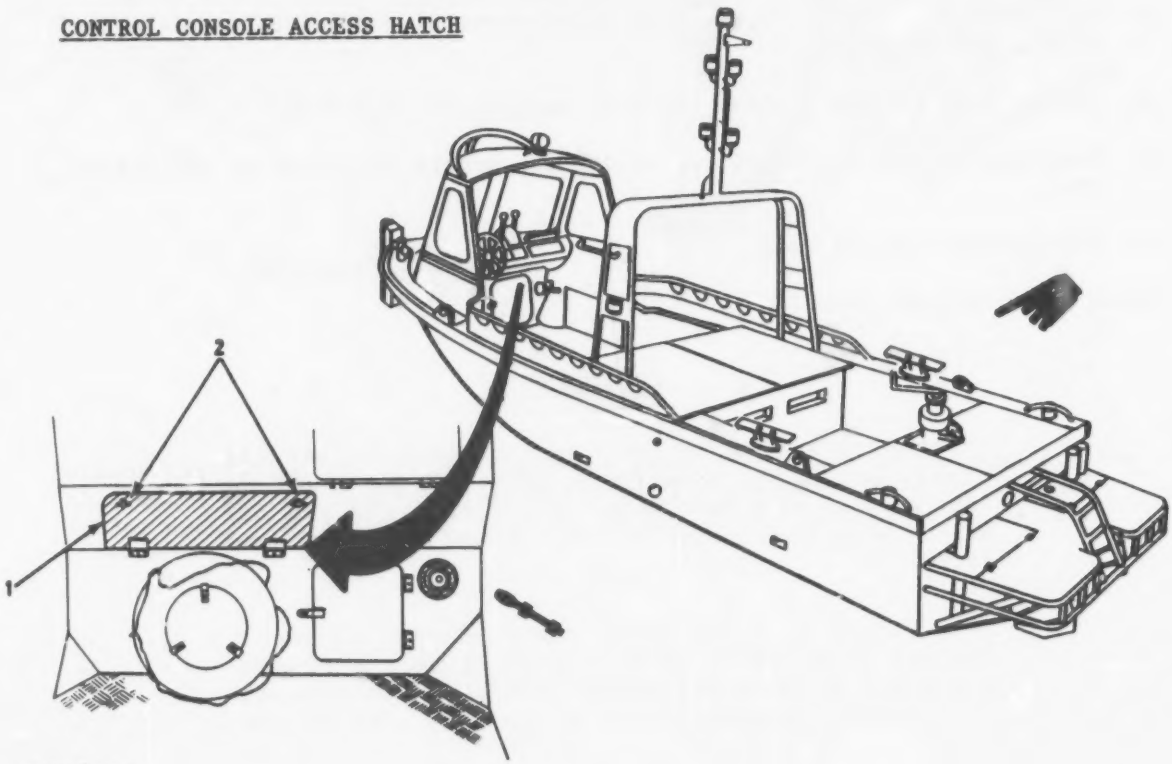
Opening and Securing:

1. Open hydrojet hatch (1) (port or starboard).
2. Swing securing brace (2) upward into grooved slot (3) on hatch.

Closing:

1. Grasp edge of hydrojet hatch (1) (port or starboard) and push open to clear securing brace (2).
2. Remove securing brace (2) from grooved slot (3) on hatch (1).
3. Swing securing brace (2) down into stored position.
4. Close hydrojet hatch (1) by lowering to closed position.

CONTROL CONSOLE ACCESS HATCH



Opening:

Open access hatch (1) under control console by removing two wing nuts (2) and swinging hatch (1) down.

Closing:

Close access hatch (1) and install two wing nuts (2). Tighten finger tight.

REFUELING

WARNING

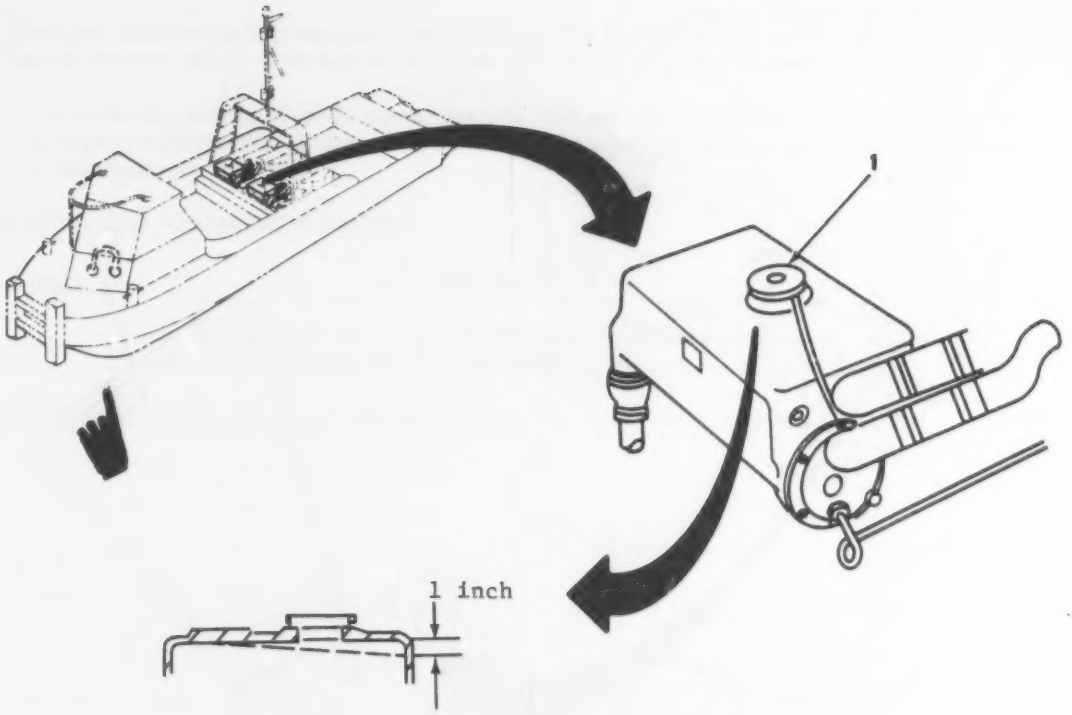
Diesel fuel is flammable. Do not allow smoking or any open flames near the boat when you are refueling.

1. Shut off engines.
2. Clean off any dirt that could get into the tank.
3. Unscrew the filler cap and remove.
4. Fill up tank. Make sure you have metal-to-metal contact between the fuel nozzle and the tank.
5. Do not fill fuel tank above the full mark on the dipstick.
6. When you're through refueling, remove the nozzle and screw on the filler cap.
7. Wipe up any spilled fuel.

FRESH WATER COOLANT LEVEL

WARNING

If cooling system is hot, open coolant filler cap slowly until all pressure is gone. Do not touch the hot cap with your bare hand. Never take the cap off while the engine is overheated. Allow it to cool down first.

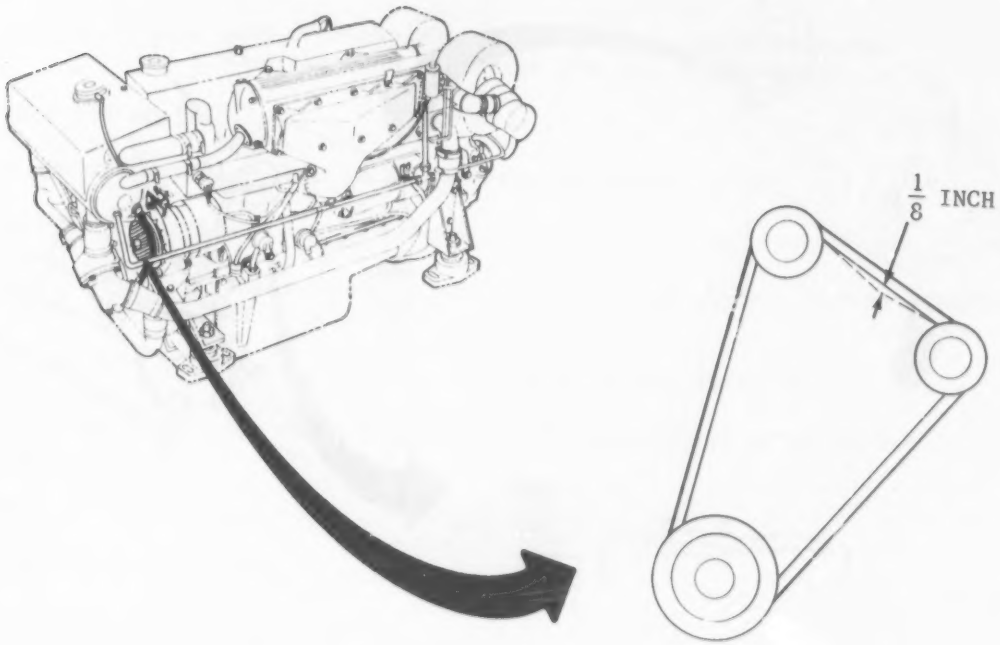


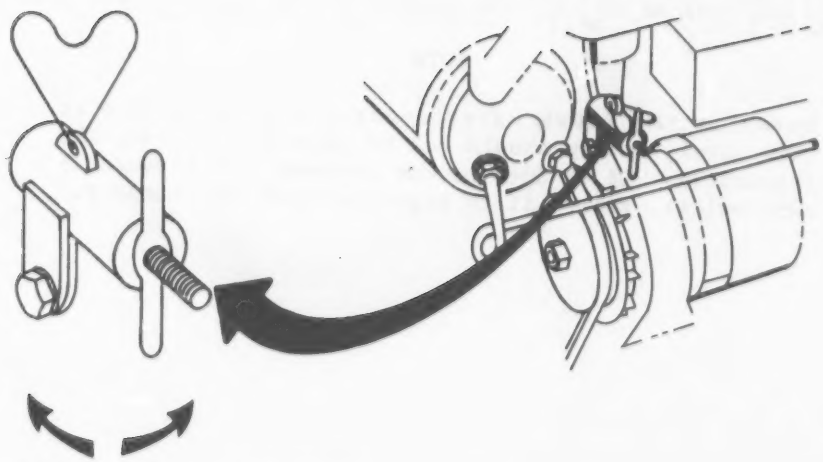
Remove the filler cap (1) and check the level of coolant in the header. You should see coolant approximately one inch (25 cm) below the bottom of the filler neck. Add coolant to fill the header if the coolant level is low.

NOTE

Normally the fresh water coolant will stabilize at this level, and it should not be necessary to top off frequently. If it does become necessary to frequently add coolant, report it to organizational maintenance.

CHECKING AND ADJUSTING V-BELT.





1. Check the V-belt tension by pressing down or pulling up on the belt halfway between the water pump pulley and the alternator pulley. If the belt has more than 1/8 inch free play, the belt needs to be tightened.

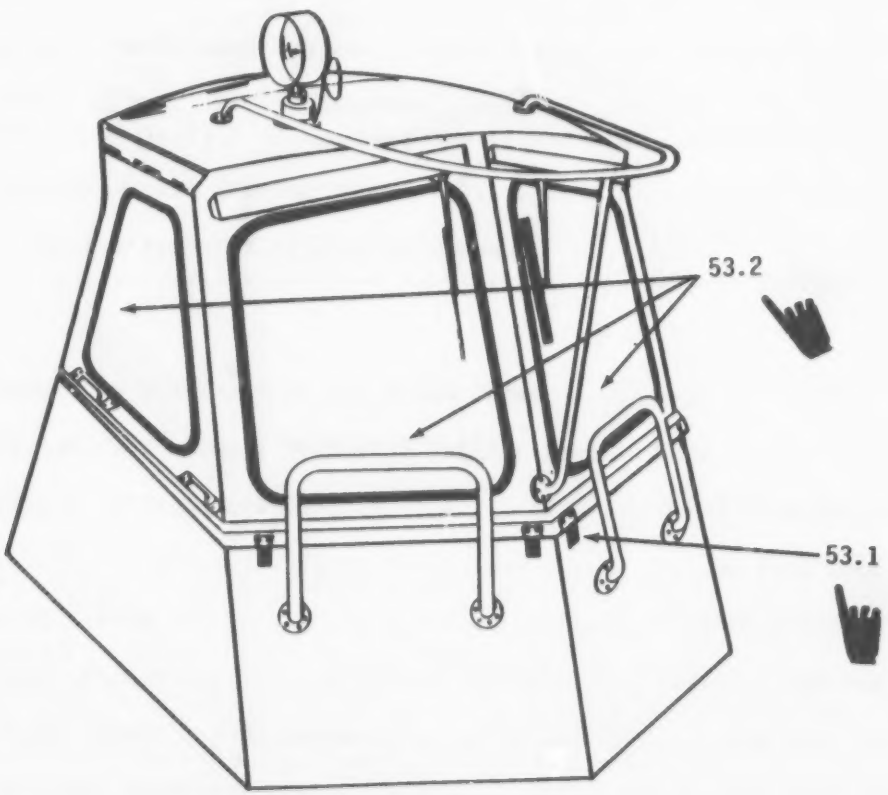
2. To adjust the belt tension, lift up the adjuster assembly lock and turn the adjuster nut clockwise to loosen tension and counterclockwise to increase tension. Position the adjuster nut so that it can be locked in position with the adjuster assembly lock.

CLEANING CAB WINDSHIELD PANELS

CAUTION

Windshield panels are plastics and should not be cleaned with abrasive or chemical cleaning compound or solution.

Clean windshield panels using a soft cloth and mild soap and water (item 2, Appendix C).



APPENDIX A

REFERENCES

A-1. SCOPE

This appendix lists all forms, field manuals, and technical manuals and miscellaneous publications referenced in this manual.

A-2. FIELD MANUALS

First Aid for Soldiers.....FM 21-11

A-3. TECHNICAL MANUALS

Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Bridge Erection Boat Cradle.....TM 5-2090-202-12&P

Operator and Organizational Maintenance Manual for Ribbon Bridge.....TM 5-5420-209-12

The Army Maintenance Management Systems (TAMMS).....DA Pam 738-750

Hand Receipt Covering Boat, Bridge Erection, Twin Jet, Aluminum Hull.....TM 5-1940-273-10-HR

Equipment Record Procedures (Marine Corps).....TM 4700-15/1

Procedures for Destruction of Equipment to Prevent Enemy Use.....TM 750-244-3

A-4. FORMS

Recommended Changes to Publications and Blank Forms.....DA Form 2028

Recommended Changes to Equipment Technical Publications.....DA Form 2028-2

Recommended Changes to Technical Publications.....NAVMC Form 10772

Hand Receipt.....DA Form 2062

Equipment Control Record.....DA Form 2408-9

Quality Deficiency Report.....SF 368

Quality Deficiency Report for MC users.....MCO 4855.10

Marine Corps Military Incentive Awards Program.....MCO 1650.17

A-5. MISCELLANEOUS PUBLICATIONS

Lubrication Order.....LO 5-1940-277-12, LI 1940-12

Expendable/Durable Items
(Except: Medical, Class V,
Repair Parts, and Heraldic
Items).....CTA 50-970

Identification and Distribution of
DA Publications and Issue of Agency
and Command Administrative Publications.....AR 310-2

Standard Characteristics (Dimensions, Weight,
and Cube) for Transportability of Military
Vehicles and Other Outsize/Overweight Equipment.....TB 55-46-1

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the bridge erection boat to help you inventory items required for safe and efficient operation.

B-2. GENERAL

The components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items (BII). These are the minimum essential items required to place the bridge erection boat in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the bridge erection boat during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1) - Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

b. Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number. If item needed differs for different models of this equipment, the model is shown under the "Usable On" heading in this column.

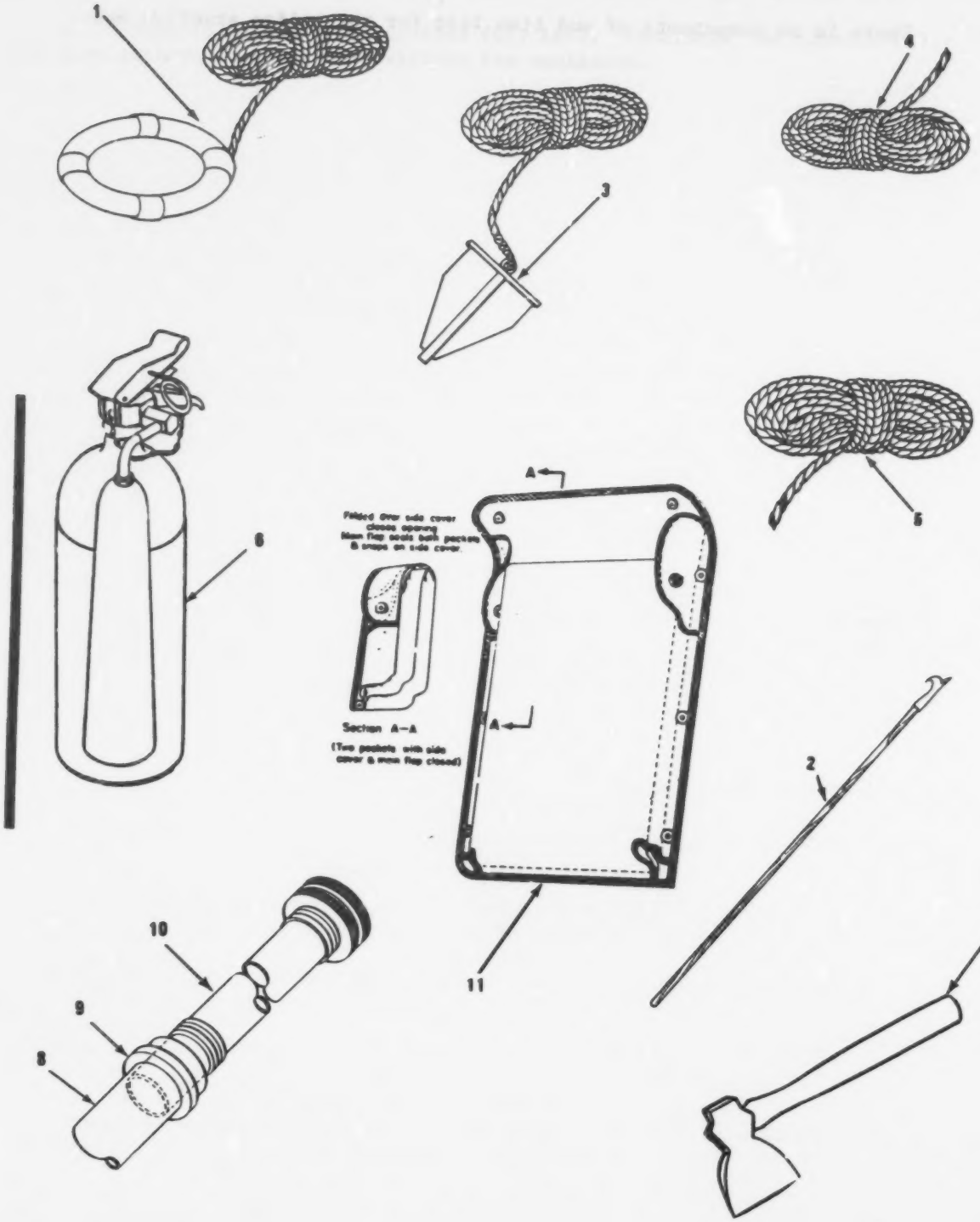
d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5) - Quantity Required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM

There is no components of end item list for the bridge erection boat.

Section III. BASIC ISSUE ITEMS



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) USABLE ON CODE	(5) U/M	(6) QTY RQR
1	4220-00-275-3156	Ring, Buoy, MIL-R-16847 (97403) 13213E5456-12		EA	1
2	2040-00-007-1136	Hook, Boat (97403) 13216E9929 (on port side gunwale by forward cockpit)		EA	1
3	2040-00-997-6047	Anchor and Anchor Line Assembly (97403) 13213E5513 (in stowage compartment, starboard side of forward cockpit)		EA	1
4	4020-00-033-4735	Line, Mooring (97403) 13213E5511		EA	4
5	2030-00-997-6041	Line, Steering (97403) 13213E5510		EA	2
6	4210-00-270-4512	Extinguisher, Fire P/N 896990 FSCM 33525		EA	1
7	5110-00-555-8868	Hatchet, Borad (80244) GGG-H-131TYF		EA	1
8		Adapter, Hose (97403) 13226E0280		EA	1
9		Reducer, Hose, 1 NH est. thd. 3/4 13218E0470-35		EA	1
10		Hose Assembly rubber, water service, with 3/4 - 1-1/2 NH couplings, type optional, 3/4 IDX, 50 ft. long, Grade A, Class 1		EA	1
11	7520-00-559-9618	Case, Maintenance, Canvas with 2 pockets 81349 MIL-C-11743		EA	1

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APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the bridge erection boat. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

C-2. EXPLANATION OF COLUMNS

a. Column (1) - Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, Item 5, App. C").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

(enter as applicable)

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column (3) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	9150-00-190-0907	Grease, Automotive and Artillery (GAA), (81349), MIL-G-10924	LB
2	C	7930-00-249-8036	Detergent, General Purpose (81348) P-D-220	
3	C	9150-00-186-6681	Oil, Engine, OE/HDO-30 MIL-L-2104	QT
4	C	9150-00-189-6727	Oil, Engine, OE/HDO-10 MIL-L-2104	QT
5	C	9140-00-286-5297	Fuel, Diesel, DF-2 VV-F-800	GL
6	C		Dry Cleaning Solvent SD-2	GL
7	C	4020-00-968-1356	Rope, Nylon (MIL-R-17343)	RL

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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Brigadier General, United States Army
The Adjutant General

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COA, 3d ENGINEER BN
FT. LEAVENWORTH, MO 63108

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BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 Cylenders. The engine on my set only has 4 Cylenders. Change the manual to show 4 Cylenders.

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

"SAMPLE"

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (263) 317-7111

SIGN HERE John Doe
JOHN DOE

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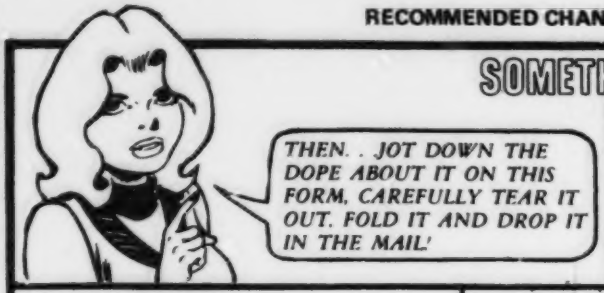

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.365	metric tons	short tons	1.102
pound-inches	mewton-meters	.11375			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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